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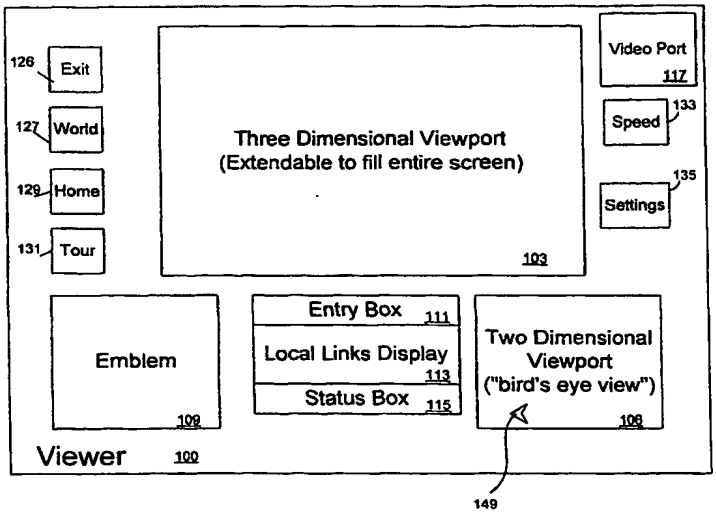

(57) Abstract

An apparatus and method are disclosed for displaying three dimensional representation or worlds and navigating through such worlds. In an apparatus embodiment, a viewer user interface (100) adapted to present information that is organized into a discrete chunk of space to a user is disclosed. The information potentially includes links and/or objects that are associated with specific locations in the space. The viewer user interface includes a first viewport (103) for presenting a three dimensional representation of the space from the viewpoint of a position within the space, and a second viewport (149) for presenting a two dimensional birdseye view representation of the discrete chunk of space. The viewer further includes a third viewport (109) for presenting an identifier that the discrete chuck of space is associated with.

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Systems and Methods for Displaying Three Dimensional Representations and an Associated Separate Web Window

BACKGROUND OF THE INVENTION

The present invention relates generally to mechanisms for displaying three dimensional representations or virtual reality worlds. More specifically, the present invention relates to method and apparatus for viewing such three dimensional worlds.

One conventional mechanism for creating and displaying three dimensional (3D) worlds implements virtual reality modeling language (VRML). Conventionally, VRML is used to "model" three dimensional worlds using simple polygon structures. The first version of VRML allows for the creation of virtual worlds with limited interactive behavior and is currently the most popular foundation for creating interactive 3D multimedia on the Internet. As will be appreciated by those skilled in the art, International Standard ISO/IEC 14772 describes the standard VRML file format.

Worlds created using VRML can contain objects which have hyper-links to other worlds, HTML documents or other valid MIME types. When the user selects an object with a hyper-link, the appropriate MIME viewer is launched. When the user

selects a link to a VRML document from within a correctly configured WWW browser, a VRML viewer is launched.

Although the conventional VRML viewer work well under certain conditions, it has associated disadvantages. For example, if the 3D world is relatively large, it is difficult to orient oneself within the world. That is, as one navigates within the 3D world, it is easy to get lost. This is partially because standard VRML viewers do not provide any frame of reference for where you are currently located within the VRML 3D world. Additionally, even when a 3D world is relatively small in size, navigational problems may still arise when certain portions of the 3D world have a similar appearance. In this case, it is especially difficult to distinguish between similar portions of the world and navigate to a desired location of the 3D world.

Navigational problems are compounded since each VRML world may have an infinite size. In other words, there are no constraints placed on how large a VRML world may be. Thus, VRML world builders may build relatively large and complex worlds. As VRML worlds becomes larger and more complex, it becomes increasingly more difficult to view and navigate through such gargantuan worlds. Finally, when a VRML world is relatively complex, it requires a relatively long rendering time since each portion of the 3D world is analyzed and rendered from polygon structures.

In view of the foregoing, there is a need for improved mechanism for viewing and navigating through 3D worlds.

SUMMARY OF THE INVENTION

Accordingly, the present invention provides an apparatus and method for displaying three dimensional representations, spaces, or worlds and navigating through such worlds. In general terms, the navigation and display mechanisms and techniques provide one or more frame of references that indicate where the user is currently located within the three dimensional world.

In one embodiment, a viewer user interface adapted to present information that is organized into a discrete chunk of space to a user is disclosed. The information potentially includes links and/or objects that are associated with specific locations in the space. The viewer user interface includes a first viewport for presenting a three dimensional representation of the space from the viewpoint of a position within the space, and a second viewport for presenting a two dimensional birdseye view representation of the discrete chunk of space. The viewer further includes a third viewport for presenting an identifier that the discrete chuck of space is associated with.

In an alternative embodiment, a viewer user interface adapted to present information that is organized into a discrete chunk of space having a plurality of sections to a user is disclosed. The information potentially includes links and objects including at least some of images, sound clips, video clips and sprites that are associated with specific locations in the space. The viewer user interface includes a first viewport for presenting a three dimensional representation of the space from the viewpoint of a moveable reference position within the space, and a second viewport for presenting a two dimensional birdseye view representation of the discrete chunk of space. The second viewport is arranged to indicate the current reference position. The viewer also includes

a third viewport for presenting a identifier that the discrete chuck of space is associated with, and an entry bar arranged to identify the discrete chunk of space that the first and second viewports are presenting. The viewer further includes a local link viewer arranged to identify links in selected locations that are adjacent to the current reference position, and a status box arranged to present status information.

In another aspect of the invention, a viewer user interface adapted to present information that is organized into a discrete chunk of space having an array of tiles to a user is disclosed. The information potentially includes links and assets including at least some of sound clips, video clips and sprites that are associated with specific locations in the space. The viewer user interface includes a first viewport for presenting a three dimensional representation of the space from the viewpoint of a moveable reference position within the space. and a second viewport for presenting a two dimensional birdseye view representation of the discrete chunk of space. The second viewport is arranged to indicate the current reference position. The viewer also includes a local link viewer arranged to identify links in selected tiles that are adjacent to a current reference tile that includes the current reference position.

In a method aspect. a method of displaying a three dimensional representation is disclosed. A first three dimensional view of the three dimensional representation is changed to a second three dimensional view of the three dimensional representation after receiving an input signal indicating movement within the three dimensional representation. A first position of a reference object within a discretely sized two dimensional representation is changed to a second position. The reference object is associated with the three dimensional representation. The first position corresponds to

the first three dimensional view, and the second position corresponds to the second three dimensional view.

In another aspect, a display system for displaying a three dimensional world is disclosed. The display system includes a three dimensional display window arranged to output at least a portion of the three dimensional world, and a two dimensional display window arranged to output a static two dimensional representation of the three dimensional world that includes a position indicator associated with the portion of the three dimensional world that is displayed in the three dimensional display window.

In yet another embodiment, a computer readable medium containing program instructions for displaying a three dimensional representation is disclosed. The computer readable medium includes computer readable code for changing a first three dimensional view of the three dimensional representation to a second three dimensional view of the three dimensional representation after receiving an input signal indicating movement within the three dimensional representation and computer readable code for changing a first position of a reference object within a discretely sized two dimensional representation to a second position. The reference object is associated with the three dimensional representation, the first position corresponding to the first three dimensional view and the second position corresponding to the second three dimensional view. The computer readable medium also include computer readable medium for storing the computer codes.

These and other features and advantages of the present invention will be presented in

more detail in the following specification of the invention and the accompanying figures which illustrate by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be readily understood by the following detailed description in conjunction with the accompanying drawings, wherein like reference numerals designate like structural elements, and in which:

Figure 1 is diagrammatic representation of a viewer system for displaying three dimensional representations in accordance with one embodiment of the present invention.

Figure 2 is a screen shot illustrating the viewer of Figure 1 as it displays a particular three dimensional representation in accordance with one embodiment of the present invention.

Figure 3 is a screen shot of a pull down menu that is selectable from the entry box of the viewer in accordance with one embodiment of the present invention.

Figure 4 is a screen shot illustrating an option pull down menu of the viewer in accordance with one embodiment of the present invention.

Figure 5 is a screen shot illustrating a world list display box within the viewer in accordance with one embodiment of the present invention.

Figure 6 is a screen shot illustrating a settings input box that is displayed when the settings button, for example, of the viewer is selected in accordance with one embodiment of the present invention.

Figure 7 is a flowchart illustrating a rendering procedure implemented by the viewer of Figure 1 in accordance with one embodiment of the present invention.

Figure 8 is a flowchart illustrating the operation of Figure 7 for rendering of the three dimensional viewport of Figure 1 in accordance with one embodiment of the present invention.

Figure 9 is a flowchart illustrating the operation of Figure 8 for rendering MIDI blended/unblended sound objects in accordance with one embodiment of the present invention.

Figure 10 is flowchart illustrating the operation of Figure 8 for rendering wave blended/unblended sound objects in accordance with one embodiment of the present invention.

Figure 11 is a flowchart illustrating the operation of Figure 8 for rendering a three dimensional display in accordance with one embodiment of the present invention.

Figure 12 is a flowchart illustrating the operation of Figure 11 for rendering the background into one or more buffers in accordance with one embodiment of the present invention.

Figure 13 is a flowchart illustrating the operations of Figure 11 for rendering the ceiling and floors in accordance with one embodiment of the present invention.

Figure 14 is a flowchart illustrating the operation of Figure 11 for rendering walls and sprites on walls within the three dimensional representation in accordance with one embodiment of the present invention.

Figure 15 is a flowchart illustrating operation of Figure 11 for rendering sprite objects that are not in locations that contain walls in accordance with one embodiment of the present invention.

Figure 16 is a flowchart illustrating the operation of Figure 7 for updating the local links viewer in accordance with one embodiment of the present invention.

Figure 17 is a flowchart illustrating the operation of Figure 7 for updating the two dimensional viewport in accordance with one embodiment of the present invention.

Figure 18 is a flowchart illustrating a process for updating the world list in accordance with one embodiment of the present invention.

Figure 19 is a flowchart illustrating the process for loading a selected link in accordance with one embodiment in the present invention.

Figure 20 is a flowchart illustrating the operation of Figure 19 for loading the three dimensional representation in accordance with one embodiment of the present invention.

Figure 21 is a flowchart illustrating the process for sending and receiving 3D email in accordance with one embodiment of the present invention.

Examples of 3D worlds and corresponding web displays are illustrated in Figures 22-27 in accordance with one embodiment of the present invention.

Figure 28 is a flowchart illustrating a process for creating a token file in accordance with one embodiment of the present invention.

Figure 29 illustrates how the token is then installed within the associated builder in accordance with one embodiment of the present invention.

Figure 30 is a flowchart illustrating the process for building a 3D world with the token in accordance with one embodiment of the present invention.

Figure 31 is a flowchart illustrating a process of rendering the token within the viewer in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

Reference will now be made in detail to a specific embodiment of the invention. An example of this embodiment is illustrated in the accompanying drawings. While the invention will be described in conjunction with this specific embodiment, it will be understood that it is not intended to limit the invention to one embodiment. On the contrary, it is intended to cover alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims. In the following description, numerous specific details are

set forth in order to provide a thorough understanding of the present invention. The present invention may be practiced without some or all of these specific details. In other instances, well known process operations have not been described in detail in order not to unnecessarily obscure the present invention.

In general terms, the present invention provides mechanisms and techniques for displaying three dimensional (3D) representations, spaces, or worlds and for navigating through such 3D representations. A graphical user interface is provided within a "viewer" for displaying and navigating through the 3D representations. Among other features, the viewer provides mechanisms for determining a current location within the currently displayed 3D representation. The frame(s) of reference of the viewer allow the user to navigate freely through the 3D representation without getting lost.

In one embodiment, each 3D representations is in the form of a discretely sized chunk and may be linked to other 3D representations. Thus, the viewer facilitates navigation through one chunk at a time. In other words, the viewer loads and displays discretely sized 3D representations. In the illustrated embodiment, the 3D world corresponds to a 16 by 16 array of tiles, locations, or sections. Each tile is associated with one or more objects and/or links that are executable or displayable within the 3D world. A column of viewable space within the 3D world may correspond to a particular tile and its associated objects and/or links.

By way of example, a particular tile of a populated construction site may be associated with image objects that are displayed within the associated column of space of the 3D world. The particular tile may have a floor image, such as a brick

sidewalk portion, that is displayed within the corresponding location within the 3D world. The particular tile may also have an associated 3D object, such as a grocery store, that is displayed on top of the floor image in the 3D world. In other words, a particular viewable space within the 3D world may be associated with a tile having one or more objects that are displayed at various viewing levels within the associated viewing space. Besides having an associated floor image and a 3D object, the particular space or tile may also include an overhead image, such as a "cloudy sky" image that is displayed over the floor and 3D object images.

Besides including images, a particular space may also include various objects that are executed by various software applications. In the above described example, the particular space and tile may include a URL link to a grocery company's web site. By way of other examples, the space may include any type of object, such as a video clip or a Microsoft Word document.

The viewer may also allow access to other 3D representations through various mechanisms. For example, the viewer may provide mechanisms for jumping from a first 3D representation to a second 3D representation that is linked to the first 3D representation. Thus, even though the viewer may only display a single 3D chunk at one time, there is no limit to how many 3D representations may be accessed and displayed.

Figure 1 is diagrammatic representation of a viewer system 100 for displaying three-dimensional representations in accordance with one embodiment of the present invention. As shown, the viewer 100 includes a three dimensional viewport 103 and a two dimensional viewport 106. The three dimensional (3D) viewport is configured

to display a portion of the three-dimensional representation as the user navigates through the 3D representation. The 3D viewport may be extendable such that the entire viewer 100 space is filled by the 3D viewport.

As the user moves through the 3D representation, the user's immediate surroundings are displayed within the 3D viewport 103. The surroundings are displayed as a virtual reality type environment, which is based on the user's position within the 3D representation. The 3D environment may include various displayed 3D objects, and one or more of the 3D objects may be linked to one or more executable objects (*e.g.*, a web page or another 3D representation)

The two dimensional (2D) viewport 106 displays a 2D perspective of most or preferably all of the 3D representation. For example, the 2D viewport 106 displays a birdseye view of the entire 3D representation. That is, the 2D viewport 106 provides the user with a 2D map of the 3D representation. The 2D viewport 106 may also include a current location indicator 149 for providing the user with a frame of reference for the user's current location within the 2D representation, as well as the 3D representation. The current location indicator 149 within the 2D viewport 106 is tied to the user's position within the 3D representation. In other words, as the user's view and environment changes within the 3D viewport 103, the current location indicator's position 149 within the 2D viewport will correspondingly change to indicate the user's new position within the 3D representation.

Additionally, the current location indicator 149 may indicate a viewing direction. As shown, the current location indicator 149 is in the form of an arrow that points towards the western portion of the 2D viewport 106. In this example, the

current location indicator 149 indicates that the user is looking towards the western portion of the 3D representation.

In sum, the current location indicator 149 provides the user with a useful mechanism for determining where they are currently located and in which direction the user is looking within the 3D representation. Thus, the user does not have to wander aimlessly within a 3D representation; they can simply determine their position and viewing direction within the 3D representation by checking the current location indicator's position and direction 149 within the 2D representation.

The viewer 100 may also include other features for allowing the user to quickly assess their current position within the 3D representation. For example, the viewer 100 may also include a local link viewer 113. The local link viewer 113 is configured to display links that are relatively near or adjacent to the user's current position within the 3D representation. A link may reference any type of executable object. For example, a link may reference a web page, a video clip, or another 3D representation.

Links that are positioned near the user may be displayed in the local link viewer 113. In the embodiment shown, links are displayed along two aisles down which the user is navigating and each aisle displays up to four links. This embodiment is particular useful in shopping applications. As the user walks down virtual shopping aisles, nearby items on each aisle are displayed as links. Alternatively, links may be displayed that are within a certain distance from the user's current location. By way of another example, the local link viewer 113 may display only the links that are positioned closest to the user's current location.

In one embodiment, each column of space within the 3D world is associated with a populated construction site tile. Each column of space and associated tile may have one or more object or object links. Thus, when a user is positioned within a specific column of space within the 3D world, she is near or adjacent to other columns of space and associated tiles. Thus, the user may be positioned near or adjacent to other attribute instances that were placed on the other near or adjacent tiles. If these nearby attribute instances are in the form of links, they may be displayed within the local link viewer 113.

A status box 115 may also be provided for displaying useful information to the user. For example, when a pointer, such as a mouse, is moved over a particular location within the 3D viewport 103, the status box 115 may identify any links or objects that are associated with the location. For example, a name of the associated link or object may be displayed within a text box positioned over the associated location within the 3D representation.

Additionally, the viewer 100 may include an entry box 111 for directly selecting a link within the 3D representation. When a link that references another 3D representation is selected, the 3D viewport 103 switches from displaying the current 3D representation to displaying a second 3D representation that corresponds to the selected link. Alternatively, when a link that references an executable object associated with a particular software application is selected, the link is loaded by the associated application.

One or more 3D representations may be grouped together and associated with an emblem. As shown, an emblem 109 is displayed by the viewer 100. The emblem

109 indicates to which group or category the currently displayed 3D representation belongs. A 3D representation may also belong to a hierarchical list of 3D representations. Within the hierarchical list, a particular 3D representation may be associated with a parent 3D representation.

The viewer 100 may also provide a mechanism for displaying one or more hierarchical lists. As shown, the viewer 100 includes a world button 127. When the world button 127 is selected, a hierarchical list is displayed that includes several 3D representations that form part of a tree structure. A user may select and go to a particular 3D representation by selecting a 3D representation from the hierarchical list. The selected 3D representation is then displayed within the 3D viewport 103.

A particular 3D representation may be defined as a home 3D representation. By way of example, a user may define a 3D representation of their hometown as their "home" 3D representation. Accordingly, a home button 129 is provided within the viewer 100 so that the user may quickly jump back to their defined home 3D representation. When the user selects the home 3D representation via the home button 129, the home 3D representation is displayed within the 3D viewport 103.

The currently displayed 3D representation may include several predefined tour routes. When a particular tour route is selected, the user's travel through the 3D representation is automated into a predefined route having predefined events that are defined by the selected tour route. A tour route may be selected in any suitable manner. For example, a tour may be automatically activated when the user navigates over a particular location within the 3D representation. As shown, the viewer 100

also includes a tour button 131 for selecting a tour associated with the currently displayed 3D representation.

As described above, particular locations within the 3D world may be linked to other worlds or executable objects, such as URL sites or video clips. As a user travels between these different links and objects, mechanisms may be provided for jumping back to previously traveled links or forward again to previously traveled links. For example, a user may travel from a first world to a second world to a third world. The user may then wish to travel back to the second world. Thus, a previous button (shown in Fig. 2 as 137) may be selected, and the user jumps back to the second world. The user may then wish to travel forward again (*e.g.* to the third world), and this may be accomplished by utilizing a next button (shown in Fig. 2 as 139). When a link is loaded by a web browser and the user travels from the first link to other links via the web browser, the user may wish to jump all the way back to the 3D world that was displayed before the first link was loaded and displayed. Thus, an exit button 126 is provided to allow the user to travel all the way back to the 3D world from which the link was loaded.

The viewer 100 may also include various mechanisms for choosing how the 3D representation is displayed and how associated navigation tools within the viewer 100 function. As shown, the viewer 100 includes a settings button 135 and a speed button 133. The speed button 133 allows the user to quickly toggle through various speeds for navigating within the 3D representation. As the user selects different speeds, it appears as though the user is traveling at different rates within the 3D representation, as displayed within the 3D viewport 103.

Other characteristics for displaying the 3D representation may also be selected or modified through the settings button 135. This feature, along with other features, of the viewer 100 are further described below.

Figure 2 is a screen shot illustrating the viewer 100 of Figure 1 as it displays a particular 3D representation in accordance with one embodiment of the present invention. As shown, the 3D representation is in the form of a mall. A corresponding birdseye view of the entire 3D representation is displayed within the 2D viewport 106.

The currently displayed three dimensional representation is associated with a specific emblem 109. As shown, the emblem 109 is in a form of a mall exterior. Other 3D representations may be associated with the same emblem 109. For example, 3D representations that are associated with the mall emblem 109 may include a mall court yard, a number of shops within the mall, a mall information booth, and the currently displayed mall interior.

Other display areas within the viewer 100 contain information associated with the currently displayed 3D representation 103. As shown, the entry box 111 contains a reference to the name of the currently displayed 3D representation (e.g., lobby). The local link viewer 113 displays links that are in proximity to the current location within the 3D representation. Any suitable number of links may be displayed that are near or adjacent to the current location. Preferable, the displayed links' positions within the local link viewer 113 correspond to the links' position within the 3D representation. As shown, Nabisco store URL links are displayed along the right side

of the local link viewer 113. Correspondingly, a Nabisco store 147 is displayed within the 3D representation 103 to the right of the 3D viewport 103.

As shown, a text box for the Nabisco store link is also displayed on the Nabisco store front. In one embodiment, a link text box is displayed when an input device, such as a mouse controlled pointer, is positioned over a link in the 3D representation. The link name may also be displayed within the status box 115, as shown, when the input device is positioned over or near the link in the 3D representation.

In one embodiment, the 3D viewport 103 includes a view direction marker 145. This marker 145 indicates a viewing direction within the 3D representation 103. As shown, the marker 145 indicates that a northern portion of the 3D representation 103 is currently being displayed. This marker 145 may be useful when the user is traveling in the direction that is opposite to the viewing direction. For example, if the user is walking in a northern direction within the 3D representation and looking toward the western portion of the 3D representation, the marker 145 is positioned along the left side of the 3D viewport, 103.

Figure 3 is a screen shot of a pull down menu 302 that is selectable from the entry box 111 of the viewer 100. As shown, the pull down menu 302 includes a list of links associated with the currently displayed 3D representation. Additionally, the pull down menu 302 includes a link to the currently 3D representation, which link is highlighted. The links displayed within the pull down menu 302 may be selectable. When a link is selected from the pull down menu 302, a 3D representation that corresponds to the selected link is displayed within the 3D viewport 103. Thus, the

displayed 3D representation may be changed to another 3D representation by selecting a link to another 3D representation from the pull down menu 302.

Links may also be selected via an option pull down menu 402 that is accessible by a right click of the mouse button within the 3D viewport 103. Figure 4 is a screen shot illustrating an option pull down menu. 402 of the viewer 100 in accordance with one embodiment of the present invention. As shown, links may be selected directly from the options menu 402. For example, the adjacent Nabisco link may be selected from the pull down menu 402. Additionally, the links associated with the currently displayed 3D representation may be accessed and selected through either the link pull down menu 302 or the option pull down menu 402.

Thus, the viewer 100 may provide several alternatives for selecting a link associated with the currently displayed 3D representation. A link may be selected through the two pull down menus (302 and 402). Alternatively, a link may be selected through the "world" button 127. Additionally, a link may be selected by moving over a position within the 3D representation that includes a link or by clicking on such position. By way of a final example. a link may be selected by clicking on the link within the 2D representation displayed in the 2D viewport 106.

The 2D viewport 106 may include any suitable mechanism for allowing access and selection of a link associated with the currently displayed 3D representation. In one embodiment, a link may be selected by clicking once or clicking twice on a position within the 2D representation that includes a link. A single click immediately activates the link. For example, if the link references second 3D representation. the second 3D representation is displayed within the 3D viewport

103. When the selected link references an executable object, the object is loaded and executed by the appropriate application. In contrast, when a user double clicks on a link in the 2D representation, the user first walks through the currently displayed 3D representation to the selected link, and then the object referenced by the link is activated (*e.g.*, a second 3D representation is loaded and displayed).

Returning to Figure 4, the options pull down menu 402 may include one or more features that are duplicated on the buttons of the viewer (*e.g.*, the world 127, the home129, the tour 131, the "prev" 137, the "next" 139, the speed 133, and the settings 135 buttons). For example, a previous or next site may be selected; the home 3D representation may be selected; a world list may be displayed; the speed may be changed; and the settings may be changed through the option pull down menu 402, as well as the buttons.

The option menu 402 allows access to features even when the corresponding button is not displayed. In certain modes, the 3D viewport 103 is expanded and covers the button area. In this event, the features that were once selectable through the lost buttons are not inaccessible since the same features are available through the options menu 402.

Figure 5 is a screen shot illustrating a world list display box 502 within the viewer 100. The world list display box 502 may be activated by the world button 127 or within the option pull down menu 402. As shown, a hierarchical list of links and markers are displayed within the world list box 502. The world list hierarchically organizes the different 3D representations. That is, each 3D representation has a parent 3D representation or a parent marker. A marker is a label for organizing a

group of 3D representations. As shown, a number of 3D representations (e.g., "travel in time", "grass", "moma", and "music") are associated with the marker "other samples."

The world list display box 502 may include other features for characterizing the different 3D representations within the displayed hierarchical list. As shown, when a particular 3D representation, such as "grass", is selected, a text description 504 appears below the world list ("meadow with pastoral sounds").

Figure 6 is a screen shot illustrating a settings input box 602 that is displayed when the settings button 135, for example, of the viewer 100 is selected. As shown, characteristics of the 3D representation may be altered within the settings dialog box 602. A height value of the 3D representation may be selected with a slider 604. The height value corresponds to how far the user's view appears to be above the floor within the 3D representation.

A horizon value may also be selected via a horizon slider 606. The horizon value corresponds to a viewing angle within the 3D representation with respect to the ground. For example, if a relatively high value is chosen for the horizon value, it appears as if the user is looking toward the ceiling of the 3D representation. In contrast, if a relatively low value is chosen for the horizon value, it appears as if the user is looking toward the floor.

A distance value may also be selected via a distance slider 608. The distance slider 608 corresponds to a viewing angle for the 3D representation. That is, the distance value corresponds to how large a portion of the 3D representation is

displayed within the 3D viewport 103. A 3D viewport size value may be chosen by selecting a corresponding viewport size button 610. The viewport size value indicates how large the actual 3D viewport 103 appears relative to the viewer 100. For example, a size value of "full size" results in a 3D viewport 103 that covers the button display area.

Objects and/or links are rendered within the viewer 100 using any suitable mechanisms. Several embodiments of rendering mechanisms are described below in reference to Figure 7 through 17. Figure 7 is a flowchart illustrating a rendering procedure 5500 implemented by the viewer 100 of Figure 1 in accordance with one embodiment of the present invention.

Initially, temporal images are updated in operation 5510. In other words, any images that require an update after a predefined period of time are updated periodically when the rendering procedure 5500 cycles back to operation 5610. By way of example, objects that are animated require that a new or next frame is displayed after each predefined time period.

After the temporal images are updated, a current viewer position is checked to determined whether a position change has occurred in operation 5520. If no change has occurred, the temporal images are periodically updated in operation 5510 and the current viewer position is periodically checked in operation 5520 to determine whether a position change has taken place.

However, if a position change has occurred, the current position is determined in operation 5530. The 3D viewport is then rendered in operation 5540 based at least

in part on the determined current position. The local links display may also be updated in operation 5550 based at least, in part, on the determined current position. Additionally, the 2D viewport 106 may be updated in operation 5560 based at least in part on the determined current position. Other features of the user interface of the viewer 100 may also require updating in operation 5570. For example, some of the buttons may be deactivated, such as the "prev" button 137 and/or the "next" button 139 (as shown in Figure 2, the next button 139 is deactivated).

Rendering of the 3D viewport is illustrated in Figure 8 in accordance with one embodiment of the present invention. Initially, a 3D display is rendered in the 3D viewport 103 in operation 5542. In other words, any images that are visual are displayed within the 3D viewport 103. Next, any sound objects may be rendered. A single sound object may be rendered for the current user position, or a plurality of sound objects may be blended together and rendered for the current position. The blended sounds may be associated with the current position or with positions that are near the current position. In one embodiment, MIDI sound objects are rendered in operation 5544, and wave sound objects are rendered in operation 5546. Although the present invention is described in terms of sound objects of MIDI or wave format, of course, any suitable sound format may be implemented. Any other type of media objects are then rendered in operation 5548, such as video clips or stream video, and the process 5540 of rendering the 3D representation ends.

The 3D representation and associated objects and/links are rendered, in part, from a world data structure. Objects and links are grouped into attribute layers within the data structure. Each attribute layer is partitioned into cells, sections, or locations

that correspond to locations within the rendered 3D representation. Additionally, the attribute layers may be conceptually layered on top of one another to associate a plurality of objects and/or links with a particular location within the 3D representation. In other words, a particular location within the 3D representation corresponds to a location or "cell" within several attribute layers, wherein each cell may contain an object or link.

In one embodiment, each cell is associated with a particular tile of the above described construction site. The different attribute instances that are placed on the particular tile are represented within a cell of an attribute layer that is associated with the particular type of attribute instance.

By layering the objects and links together on a particular location of the 3D representation, a rich, realistic 3D environment may be provided. Additionally, when executable objects and/or links are associated with 3D objects, the resulting 3D representation provides a visually appealing and logical mechanism for displaying and organizing links and objects. For example, a web page for a music catalog site may be associated with a meaningful 3D object, such as a 3D music store, or in a larger store, possibly a CD section of the music store.

Figure 9 is a flowchart illustrating the operation 5544 of Figure 8 for rendering MIDI sound objects in accordance with one embodiment of the present invention. Initially, for the current position it is determined whether there is a MIDI object in a cell of the MIDI attribute layer associated with the current location in operation 902. If there is not an associated MIDI object for the current position, any

MIDI object that is currently playing is halted or stopped in operation 908 and the process 5544 ends.

However, if a MIDI object is present within the MIDI layer for the current position, it is then determined whether the same MIDI object is currently playing in operation 904. If the same MIDI object is currently playing, playing of the MIDI object is continued in operation 910. In contrast, if the same MIDI object is currently not playing, the old MIDI object is stopped and the new MIDI object from the MIDI layer is then played in operation 906. Process 5544 then ends.

Although, only a single MIDI object is described as being played for a particular position within the 3D representation, of course, a plurality of MIDI objects may be played or a sound object of another sound format may be played for the particular position. For example, several sound objects from nearby locations may be blended together and played for the current position.

Blending of nearby sound objects is described as being implemented for wave sound objects. Figure 10 is flowchart illustrating the operation 5546 of Figure 8 for rendering wave sound objects in accordance with one embodiment of the present invention. Initially, locations that surround (or are proximate to) the current position are checked for wave objects in operation 1002. For each wave object, a volume level and one or more sound direction(s) are determined in operation 5004. For example, a left and/or a right channel may be selected for the sound direction. Sound objects are then blended using any suitable sound blending technique. For example, alpha blended audio may be implemented.

Figure 11 is a flowchart illustrating the operation 5542 of Figure 8 for rendering a 3D display in accordance with one embodiment of the present invention. In general terms, this process includes rendering of various objects into one or more buffers that are associated with one or more portions of the display area (*e.g.*, the 3D viewport 103). As shown, operations 1102 through 1108 include rendering the background, the ceilings, the floors, and the walls into one or more buffers. The rendering of the background is described in more detail below with respect to Fig. 12. The rendering of the ceilings and floors are described in more detail below with reference to Fig. 13, and the rendering of the walls is described in more detail with respect to Fig. 14.

After the background, ceilings, floors and walls have been rendered, sprites that are associated with walls are then rendered into buffer(s) in operation 1110a, and sprites that are not associated with walls are then rendered into buffer(s) in operation 1110b. As described below in reference to Figs. 14 and 15, the two different types of sprites are rendered differently.

After the buffers are filled, the buffers are then output onto the display area (*e.g.*, the 3D viewport) in operation 1112. For example, particular locations within each buffer correspond to a particular location on the display area. The data within the particular buffer location is used to generate a displayed object or image portion at the corresponding screen location. The process 5542 then ends.

Figure 12 is a flowchart illustrating the operation 1102 of Figure 11 for rendering the background into one or more buffers in accordance with one embodiment of the present invention. Initially, the left edge of the image on the

display area is determined based on the extent of the 3D viewport and viewer direction in operation 1202.

The extent of the 3D viewport 103 is defined as the viewing area. In one embodiment, the extent is the area that is displayed between the left and right of the computer screen. The viewer direction is defined with respect to the 3D representation. For example, if the user or "viewer" is looking towards the northern portion of the 3D representation, the direction is defined as north and a northern portion of the 3D world is displayed.

After the left edge of the image on the display area is determined, a current row of the image from the 3D viewport is then obtained in operation 1204. A left edge of the image row corresponding to the 3D viewport row is then determined in operation 1206. In other words, a row within the background image is matched to the row of the 3D viewport that was obtained in operation 1204.

After the left edge of the corresponding image row is obtained, pixels are copied to the 3D viewport row until the 3D viewport row is filled in operation 1208. In one embodiment, pixels are sequentially copied from the image into the viewport row. For example, if a first viewport row is twice a long as a first image row, the first image row and then a second image row are copied into the first viewport row to fill up the first viewport row. This technique allows the first viewport row to be efficiently filled without duplicating the first image row, as compared with conventional techniques.

After the 3D viewport row is full, it is determined whether there are more

rows in the 3D viewport in operation 1210. If there are more viewport rows, a current row pointer is advanced in operation 1212 such that a next row from the 3D viewport may be obtained in operation 1204. Operations 1204 through 1208 are repeated for all of the rows in the 3D viewport such that pixels may be copied from the image to the corresponding 3D viewport rows. When there are no more rows in the 3D viewport, the process 1102 ends.

Figure 13 is a flowchart illustrating the operations 1104 and 1106 of Figure 11 for rendering the ceiling and floors, respectively, in accordance with one embodiment of the present invention. Initially, a position of a plane within the 3D viewport 103 is determined relative to the floor within the 3D viewport in operation 1302. Any suitable mechanism may be implemented for calculating a position of a plane upon which the floor image will be rendered. For example, a perspective transformation may be implemented for the floor plane in operation 1302.

After the plane position is determined, pixels within the section images are mapped onto the determined plane to form the floor image within the 3D representation in operation 1304. Any suitable mapping technique may be implemented. For example, sections may be scan-converted into the 3D viewport using the section images of color texture. After the sections are scan-converted, the ceiling or floor rendering process is complete.

Figure 14 is a flowchart illustrating the operation 1108 and 1110a of Figure 11 for rendering walls and sprites on walls within the 3D representation in accordance with one embodiment of the present invention. The following operations 1406 through 1422 are implemented for each column in the 3D viewport 103 (1402) and

for each location (*e.g.*, for each tile) on the line of sight within each column of the 3D viewport (1404). Additionally, operations 1408 through 1422 are implemented on each location that has a wall (1406).

Initially, a height of the current wall on the current location is determined in operation 1408. Next, a column in the wall image that corresponds to the column in the 3D viewport is determined in operation 1410. A visible portion of the column in the 3D viewport in then determined in operation 1412. This step is done to determine whether any other objects within the 3D viewport obscure a portion or all of the wall within the 3D viewport.

Visible image column data is then mapped to the corresponding 3D viewport column in operation 1414. A distance to the wall is determined and stored for later use by the rendering procedure for sprite objects that are not located on a wall in operation 1416. It is then determined whether a sprite is located at the current location in operation 1418. In other words, it is determined whether a sprite object and a wall object are located on the same location. If a sprite object exists at the current location, a column within the sprite image is then calculated that corresponds to the 3D viewport column in operation 1420. The sprite image data is then mapped onto the 3D viewport column in operation 1422.

However, if a sprite object is not present at the current location, the rendering process of Figure 14 is repeated again for a next column in the 3D viewport starting at operation 1402. Likewise, after sprite image data is mapped onto the 3D viewport column in operation 1422, the entire rendering process is repeated for the next column

in the 3D viewport in operation 1402. After the sprite objects associated with wall objects are rendered, the process continues at operation 1110b of Figure 11.

Figure 15 is a flowchart illustrating operation 1110b of Figure 11 for rendering sprite objects that are not in locations that contain walls. Operations 1504 through 1506 are repeated for each sprite object (1502). Initially, screen dimensions are computed based on a user's current position and a sprite object's attributes in operation 1504. In other words, a bounding box is defined for the sprite object within the 3D representation. The spite object attributes may include any suitable attribute values for characterizing how the sprite image will be displayed within the 3D representation. For example, the sprite attribute values may include an image size for the sprite object or a proportion value that indicates whether the sprite object will appear stretched or shrunken within the 3D representation.

After the screen dimensions are computed, the sprite object is clipped as necessary to the 3D viewport around any obscuring walls based on information stored while rendering the walls (see operation 1416 of Figure 14) in operation 1505. In other words, pixels within the sprite image that are obscured by other walls are clipped such that they will not be displayed within the 3D representation.

Whether or not the sprite object is obscured by other walls may be determined in any suitable manner. For example, distances between a wall that may potentially obscure the sprite object and the user's current location may be compared to a distance between the sprite object and the user's current location. Thus, walls that are in same line of sight as a sprite object and also have a smaller distance to the user from the sprite object are determined to obscure the sprite object. After the sprite object is

clipped (if necessary), any visible portions of the sprite image are mapped to the clipped screen dimension of the 3D viewport in operation 1506. After the first sprite object has been rendered and additional sprites are sequentially processed in the same manner. The process 1110b for rendering sprite objects that are not located on wall then ends.

Figure 16 is a flowchart illustrating the operation 5550 of Figure 7 for updating the local links viewer in accordance with one embodiment of the present invention. Initially, names of nearby links are obtained from the link attribute layers in operation 1602. Nearby links are defined as links that are substantially near the current location within the viewer 100. For example, the nearby links may be defined as any links that are currently being displayed within the viewer 100. Alternatively, the nearby links may be defined as links that are directly adjacent (*e.g.*, on adjacent tiles) to the current location within the 3D representation. Alternatively, links that are within a predefined distance of the current location or tile may be displayed.

After the nearby link names are obtained, the links' names are displayed within the local link viewer based on positions of the nearby links' positions relative to the user's current location in operation 1604. In other words, the displayed links' positions within the local link viewer correspond to the nearby links' positions within the 3D representation. After the names are displayed, the process 5550 ends.

Figure 17 is a flowchart illustrating the operation 5560 of Figure 7 for updating the 2D viewport in accordance with one embodiment of the present invention. Initially, it is determined whether the 2D map or 2D viewport image has changed since the last update in operation 1702. The 2D map may need to be updated

for any number of reasons. For example, the current location within the 3D image may have changed, and thus, the 2D map's location indicator 149 is drawn in a new position on the 2D map 106.

If the map has changed, a new 2D image is drawn into the 2D viewport to reflect the changes since the last update in operation 1704. After the new 2D image is drawn or if it is determined that the map has not changed since the last update, the position of the current location indicator's 149 position is calculated within the 2D viewport based on a new position within the 3D representation in operation 1706.

Likewise, the current location indicator's direction within the 3D viewport is also calculated based on the user's direction within the 3D representation in operation 1708. As discussed above, the user's direction is defined as the direction within the 3D representation that the user is looking. For example, if the user is looking towards the southern portion of the 3D representation, the user's directions is "south". A location indicator image is then selected that is appropriate for the calculated direction in 1710. The location indicator is then drawn within the 2D viewport in operation 1712 based on the calculated user position and the selected location indicator image. The process 5560 for rendering the 2D viewport then ends.

Figure 18 is a flowchart illustrating a process 6200 for updating the world list in accordance with one embodiment of the present invention. As described above, the world list is a hierarchical list of 3D representations that are each associated with a parent 3D representation or a marker. An update of the world list may be performed in response to any suitable user input or automated request. For example, the user

may select the "world" button 127 and then select a 3D representation from the displayed world list.

Initially, local world list data is loaded in operation 1802. The loaded list is then parsed for sublist place holders in operation 1604. A place holder is configured to reference another list that may not be located on the local drive (e.g. located at a particular URL site). For each sublist place holder, the referenced sublist is then loaded and appended to the local world list data in operation 1808.

After the referenced external sublist(s) are appended to the local list, the currently displayed 3D representation's name and position within the world list are determined in operation 1810. The list is then displayed with the current 3D representation's name visible and/or highlighted in operation 1812. This feature allows the user to quickly assess which 3D representation is currently being displayed and how such 3D representation fits within the list.

If another 3D representation's name is selected from the list, the list is closed and the new 3D representation is loaded in operation 1814. In other words, the currently displayed 3D representation is shut down and a new 3D representation is loaded that is associated with the selected name. The updating process 6200 then ends.

Figure 19 is a flowchart illustrating the process 1900 for loading a selected link in accordance with one embodiment in the present invention. A particular link may be selected in a number of ways. For example, a link may be directly typed within the entry box 111 (see Figure 1); selected by clicking on a link within the 2D

viewport 106: selecting by clicking on a link within the local links viewer 113; or loaded by walking into a link within the 3D representation (*e.g.*, walking into a 3D building that is associated with a URL site).

When a link is selected or activated, a link name is parsed to determine the link type in operation 1902. It is then determined whether the link should be handled by a browser in operation 1904. If a browser should be used, the browser is loaded into the 3D viewport 103 in operation 1906. The link is then passed to the browser for display in operation 1908.

If a browser is not going to be used, it is then determined whether the link is associated with a 3D representation in operation 1910. If the link references a 3D representation, the associated 3D representation is loaded in operation 1914. However, if the link references another type of object, the link is passed to another mechanism that is capable of handling the particular linked object in operation 1912. For example, if the linked object is an Microsoft Word document, Microsoft Word may be executed on the document. The process 1900 for loading a link then ends.

Figure 20 is a flowchart illustrating the operation 6540 of Figure 19 for loading the 3D representation in accordance with one embodiment of the present invention. Initially, the currently displayed 3D representation is shut down in operation 2002. A data structure associated with the new 3D representation is then loaded in operation 2004. Any ancillary files associated with the data structure are then determined and loaded in operation 2006. For example, a data structure may include image files (*e.g.*, floor, wall, and ceiling images) for rendering various objects within the 3D representation. A new 3D representation associated with the loaded

data structure is then initialized in operation 2008. The process then proceeds to operation 5500 for rendering objects within the viewer 100, which process is described in Figure 7.

The viewer 100 may include additional mechanisms for handling 3D representations in conjunction with an email application. For example, the viewer 100 may allow the user to send and receive emails that include a 3D representation, along with all of its associated files. Figure 21 is a flowchart illustrating the process 2100 for sending and receiving 3D email in accordance with one embodiment of the present invention.

Initially, a 3D representation is identified in operation 2102. This may be accomplished by any suitable user interface mechanism. For example, the user may identify the 3D representation by simply opening a particular 3D representation from the "file" pull down menu within the viewer 100. After the 3D representation is identified, 3D email is activated in operation 2104, *e.g.*, by pushing an "email" button (not shown).

A "send" or "receive" operation is then identified in operation 2106. The identification may implement any suitable mechanism, *e.g.*, determining whether a "send" or "receive" email button has been selected. If a "send" operation is identified, the identified 3D representation is packaged as an email object, along with all of its associated files. That is, the package will contain all necessary files and/or links for displaying the 3D representation. An email address is then obtained in operation 2110, and the email object is then sent to the email address in operation 2112.

If a "receive" operation is identified, a received 3D package is obtained in operation 2118. The viewer 100 may be configured to access the user's email post office from another email application, such as Microsoft Outlook. Alternatively, the viewer 100 may itself include email capabilities for receiving and sending email.

After the 3D package is obtained, it is unpacked in operation 2114. In other words, the data structure and associated image files may have to be separated from the received email object. A 3D representation of the received data structure and files is then displayed within the viewer 100 as a 3D email in operation 2116. After the 3D email is displayed (or the 3D email is sent), the 3D email process 2100 ends.

Web Display Embodiments

The above described mechanisms may be utilized to display one or more web pages within a web display window, in addition to the above described 3D world within the 3D viewport 103. Figure 22 is a screen shot of the viewer 2201 in accordance with one embodiment of the present invention. As shown, the viewer 2201 includes a 3D viewport 2200 presenting a 3D world, a web display 2204 presenting a web page, a 2D viewport 2212 presenting a birdseye view of the 3D world, an emblem 2208, a local link display 2210, and a caption bar 2214 presenting a token. Several embodiments of the 3D viewport, 2D viewport, emblem, local link display are described above, while several embodiments of the token are described below with reference to Figures 28-31.

Web pages may be associated with specific locations or tiles within the 3D world or the entire 3D world itself. In one embodiment, as a user enters or clicks a

location within the 3D world, a corresponding web page is separately displayed within the web window. Thus, different web pages may be displayed while navigating within the 3D world. Alternatively, as the user moves within the 3D world, a web page may be constantly displayed within the web display.

Although the web display window is described in terms of web pages, the web display may present any suitable information that enhances the 3D world experience. For example, the web display may include anything that may be generated by HTML commands. The web display may include a secondary 3D world or a secondary 2D representation associated with the main 3D world. The web display may simply list information (*e.g.*, product lists) pertaining to what is currently being shown in the 3D world. The web display may be in the form of streaming audio and/or video that is related to the 3D world.

The web display may also include control mechanisms, such as buttons, for controlling various aspects of the 3D world, or other windows within the viewer. The control mechanisms may also include any suitable user interface devices. For example, the control mechanisms may include a button, a slider, a dial, pull down menu, a entry window, a switch, or any combination thereof.

Additionally, the web page may also be controlled. For example, the 3D world may control various content of the web page. In other embodiments, the web display may include customer help sessions, (*e.g.*, via live video, live audio, or email) to give the user a direct link to a customer support person.

The information displayed within the web display may be available through

the Internet, or any other suitable network site. Alternatively, the information may be obtained from a local disk or CDROM on the user's computer. The relative size of the various windows (*e.g.*, the 3D view and the web display) may also be alterable (*e.g.*, the web display may be larger than the 3D view). Also, the size of each window may be controlled by the Borg data structure. The user may configure the size of each window, and the selected configurations are input into the data structure.

Examples of 3D worlds and corresponding web displays are illustrated in Figures 22-27 in accordance with one embodiment of the present invention. In these examples, the user navigates through various areas of a 3D world that is in the form of a shopping mall. As the user approaches a particular object or area within the mall, information corresponding to the object or area is displayed within the web display.

As shown in Figure 22, a 3D view of the mall interior 2200 is displayed within the 3D window. As shown, the mall includes an online music shop billboard 2206. When the user approaches the music shop billboard 2206 (or clicks on the billboard), an online shopping web page 2204 corresponding to the particular music shop 2206 is displayed within the web display. In other words, the web display connects the user to the music shop's online shopping web page. The user may then select songs to be played (*e.g.*, via RealPlayer®) or to be bought over the Internet. The web page may also utilize streaming audio that is played while navigating through the 3D world.

In this embodiment, the 3D mall contains shops that have rooms dedicated to particular themes. For example, a music company may have rooms for different artists, and the rooms are decorated with various paraphernalia related to the artist.

The room may be decorated with posters of the artist and records by the artist. As the user approaches each object, relevant information about such object may be presented in the web display. For example, as the user approaches or selects an album, streaming audio may be played or a list of songs may be presented within the web display. As illustrated in Figure 23, the room contains a 3D representation of the artist 2302, such as Lenny Kravitz, for whom the room is constructed. The web display includes a list of Lenny's songs 2304 with hyperlinks to more information about particular songs or to play the song as the 3D world is navigated.

As shown in Figure 24, the 3D world includes a 3D image of a "chat booth" 2402 that looks like a telephone booth. As the user approaches or selects the chat booth 2402 within the 3D view, the web display connects to a live chat page 2404. As shown in Figure 25, various portions or areas of the 3D world 2502 may be navigated and controlled via the web display 2504. That is, the web display includes buttons for controlling how the 3D world is displayed. For example, a tour button is displayed so that the user may select a tour within the 3D world and several speed buttons are displayed so that the user may select a speed for navigating through the 3D world).

Thus, each web page may send web commands to the viewer 100 that affect how portions of the viewer are displayed. For example, the contents of the 3D world may change in response to the displayed web page. The web page may send commands to the viewer 102 in any suitable manner. In one embodiment, a web page may send a command in the form HTML links that are prefixed with "borg://." This prefix is registered with the operating system. When a "borg://" HTML link is

received, the viewer 102 interprets the link. In one embodiment, all the buttons on the viewer 100 may also be activated and/or modified by a web page. Additionally, the web page may be controlled through COM (component object model) objects. The COM objects include a plurality of methods that may be accessed.

Figure 26 shows a shop 2602 within the 3D viewer. The shop 2602 contains 3D items that are for sell. As the user approaches various objects for sale, the web display shows a standard online shopping page 2604 for purchasing such items (*e.g.*, adding the items to your shopping cart and checking out). In one embodiment, if the user clicks on an item within the 3D world (*e.g.*, a handbag), purchase information and order taking buttons are made available in the web display. As illustrated in Figure 27, the user may also enter an interior of a movie theatre 2702 within the 3D viewer. The movie theatre contains movie advertisements. As the user approaches a particular movie advertisement, the web display shows information 2704 about when the particular movie is playing. The web display may also utilize streaming video and/or audio for playing a portion of the particular movie.

Web links to web pages may be associated with a 3D world in any suitable manner.

Token Embodiments

Mechanisms may also be provided for designating who built a particular 3D world and/or ensuring that the originator of the 3D world is not distributing 3D worlds without authorization, *e.g.*, from the licensor. In one embodiment, a token is created that will be inserted into the builder. The inserted token results in a particular phrase being displayed within the viewer. For example, the inserted token may result in the phrase "for personal use only" or "unregistered builder" (as shown in the caption bar 2506 of Figure 25) being displayed within the viewer when a 3D world is generated by the licensee's builder. Otherwise, if the licensee is authorized to distribute 3D worlds, the licensee may select their own token phrase, such as "CYBERWORLD Viewer - www.cyberworldcorp.com" (as shown in the caption bar 2214 of Figure 22)." At least the token phrase is encrypted to ensure that it is unlikely to be easily copied by others or altered by the licensee after it is created.

One function of these token mechanisms is to provide ways to distinguish between unauthorized and authorized 3D worlds. Any 3D worlds that are publicly available (*e.g.*, on the web) will be appropriately marked to indicate authorization status. The source of the unauthorized 3D world may also be readily traced. For example, the owner of the web site may be tracked or the token may identify the user (*e.g.*, via a serial number). Of course, any suitable marking may be utilized to determine which 3D worlds or buyers are authorized to generate publicly available 3D worlds.

Figure 28 is a flowchart illustrating a process 3600 for creating a token file in accordance with one embodiment of the present invention. Initially, a user phrase and

serial number is input in operation 3602. The serial number is optional. The phrase and serial number are then encrypted in operation 3604. Any suitable encryption algorithms may be utilized. A token file having the encrypted phrase and serial number is then output in operation 3606. The process 3600 then ends.

The user phrase may be selected by the user of the builder or predefined based on the licensing rights of the user. For example, a user that is only entitled to use the builder for personal use may have the user phrase (*e.g.*, for personal use only) designated by the licensor. Other users may be allowed to select a personalized phrase that is distinguishable from other user's phrases (*e.g.*, a tradename). Any number of tokens may be generated for a particular user or builder by implementing process 3600. Each user phrase may be included within the same or different token file.

After the token file is created, Figure 29 illustrates how the token is then installed within the associated builder in accordance with one embodiment of the present invention. Initially, the token file is opened in operation 3702. The contents are then read and validated in operation 3704. For example, a checksum may be utilized to check whether the token phrase has been altered by the user. If a serial number is used, it may then be confirmed in operation 3706. In other words, the serial number is matched to the builder's serial number. This operation ensures that the token was not obtained by an unauthorized user with a nonmatching builder.

The encrypted phrase and human readable phrase is then added to a token list in operations 3706 and 3708, respectively. The human readable phrase may be the user phrase itself, a shortened version of the user phrase, or any suitable string that

identifies the user phrase. Of course, when the user is only authorized to use the builder for personal use, only one phrase (and no human readable phrase) may be inserted into the token list indicating that the builder is for personal use only. The process 3700 for inserting the token within the builder then ends.

Figure 30 is a flowchart illustrating the process 3800 for building a 3D world with the token in accordance with one embodiment of the present invention. Initially, a token is selected from the human readable phrases within the token file. The number and type of tokens that are available depends on the type of builder utilized and/or the particular rights of the associated user. For example, a builder that is authorized to distribute 3D worlds may include tokens that were previously chosen by the user. On the other hand, a builder that is for personal use only may include a single token that indicates this restriction through the viewer. The token may be selected by the user. Alternatively, the token may be automatically selected (*e.g.*, if there is a single token).

After the token is selected, the corresponding encrypted phrase is obtained in operation 3804. The encrypted phrase is then inserted within the Borg or world data structure that is used to generate and display the 3D world and web display. The process 3800 for building with the token then ends.

Figure 39 is a flowchart illustrating a process 3900 of rendering the token within the viewer in accordance with one embodiment of the present invention. Initially, the Borg structure is loaded into the viewer in operation 3902. The user phrase is then decrypted in operation 3904. It is then determined whether the decrypted phrase is valid in operation 3906. If the phrase is valid, the phrase is

displayed, for example, in the caption bar of the viewer in operation 3910 and the 3D world is displayed in operation 3914. If the phrase is not valid, an "invalid token" message may be displayed in operation 3912 and the process 3900 ends. Alternatively, the 3D world may also be displayed in operation 3914, along with the "invalid token" message, before ending the process 3900.

Any suitable parameters may be checked to determine validity. For example, a checksum may be determined again to check whether the token phrase has been altered. Various other checks may be performed. In one embodiment, it may be determined whether the token has been used for a longer time than a specified time limit. The builder's version may also be checked to determine whether the builder is out of date and no longer valid. The process 3900 of rendering the token then ends.

The above described token mechanisms may be applied to any suitable audio visual display generator where it is desirable to identify a user of the such generator. For example, any software that generates an audiovisual display may include the above token mechanisms to indicate whether the user is authorized to distribute the generated audiovisual displays.

Advertisement Banner Embodiments

In other embodiments, the viewer also includes an advertising banner. The advertising banner may be controlled either by the user or by a third party, such as the licensor of the builder. For example, the licensor generates an advertisement banner that is automatically displayed within a viewer that is utilized by a low-end builder. In this embodiment, the builder may include mechanisms for automatically linking to

a specific advertisement web page that is controlled by the third party or licensor. Alternatively, the user may be given control of the advertisement web page, for example, in high-end builders. In other words, the user may be allowed to generate personal advertisement banners.

The advertisement banner may have its own separate window or may replace one of the windows of the viewer. For example, the advertisement banner may be substituted in place of the local links display window 113 of figure 1.

Additionally, other aspects of the viewer may be controlled either by the user or by a third party (*e.g.*, the licensor of the builder). For example, the emblem 109 of Figure 1 may be controlled by the licensor of the builder. The licensor may wish to advertise their logo in the emblem window 109.

Although the foregoing invention has been described in some detail for purposes of clarity of understanding, it will be apparent that certain changes and modifications may be practiced within the scope of the appended claims. It should be noted that there are many alternative ways of implementing both the process and apparatus of the present invention. Accordingly, the present embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein, but may be modified within the scope and equivalents of the appended claims.

CLAIMS

WHAT IS CLAIMED IS:

1. A viewer user interface adapted to present information that is organized into a discrete chunk of space to a user, wherein the information potentially includes links and/or objects that are associated with specific locations in the space, the viewer user interface comprising:

a first viewport for presenting a three dimensional representation of the space from the viewpoint of a position within the space;

a second viewport for presenting a two dimensional birdseye view representation of the discrete chunk of space; and

a third viewport for presenting an identifier that identifies the discrete chuck of space is associated with.

2. A viewer user interface adapted to present information that is organized into a discrete chunk of space having a plurality of sections to a user, wherein the information potentially includes links and objects including at least some of images, sound clips, video clips and sprites that are associated with specific locations in the space, the viewer user interface comprising:

a first viewport for presenting a three dimensional representation of the space from the viewpoint of a moveable reference position within the space:

a second viewport for presenting a two dimensional birdseye view representation of the discrete chunk of space, the second viewport being arranged to indicate the current reference position;

a third viewport for presenting an identifier that identifies the discrete chuck of space is associated with;

an entry bar arranged to identify the discrete chunk of space that the first and second viewports are presenting;

a local link viewer arranged to identify links in selected locations that are adjacent to the current reference position; and

a status box arranged to present status information.

3. A viewer user interface adapted to present information that is organized into a discrete chunk of space having an array of tiles to a user, wherein the information potentially includes links and assets including at least some of sound clips, video clips and sprites that are associated with specific locations in the space, the viewer user interface comprising:

a first viewport for presenting a three dimensional representation of the space from the viewpoint of a moveable reference position within the space;

a second viewport for presenting a two dimensional birdseye view representation of the discrete chunk of space, the second viewport being arranged to indicate the current reference position; and

a local link viewer arranged to identify links in selected tiles that are adjacent to a current reference tile that includes the current reference position.

4. A method of displaying a three dimensional representation, comprising:

changing a first three dimensional view of the three dimensional representation to a second three dimensional view of the three dimensional representation after receiving an input signal indicating movement within the three dimensional representation; and

changing a first position of a reference object within a discretely sized two dimensional representation to a second position, the reference object being associated with the three dimensional representation, the first position corresponding to the first three dimensional view and the second position corresponding to the second three dimensional view.

5. A method as recited in claim 4, further comprising displaying names of links that are proximate to the second three dimensional view within a local link viewer.

6. A method as recited in claim 4, further comprising:

displaying a hierarchical list of related three dimensional representations after receiving an input signal indicating selection of the hierarchical list, wherein the currently displayed three dimensional representation is displayed within the hierarchical list; and

displaying a list of links associated with the currently displayed three dimensional representation after receiving an input signal indicating selection of the associated links.

7. A method as recited in claim 6, further comprising activating a selected link after receiving an input signal indicating selection of the link, wherein the link is selected from the displayed hierarchical list.

8. A method as recited in any of claims 4-7, further comprising activating a selected link after receiving an input signal indicating selection of the link

9. A method as recited in claim 8, wherein the link is selected from the three dimensional representation.

10. A method as recited in claim 8, wherein the link is selected from the two dimensional representation.

11. A method as recited in any of claims 4-10, further comprising changing a first orientation of the reference object to a second orientation within the two dimensional, wherein the first orientation corresponds to a first viewing directions of the first three dimensional view, the second orientation corresponds to a second viewing direction of the second three dimensional view, the first position of the reference object corresponds to a first current position of the first three dimensional view and second position of the reference object corresponds to a second current position of the second three dimensional view.

12. A method as recited in any of claims 4-11, further comprising changing a display characteristic of the three dimensional representation after receiving an input indicating modification of a display characteristic.

13. A display system for displaying a three dimensional world, comprising:

a three dimensional display window arranged to output at least a portion of the three dimensional world; and

a two dimensional display window arranged to output a two dimensional representation of the three dimensional world that includes a position indicator associated with the portion of the three dimensional world that is displayed in the three dimensional display window.

14. A computer readable medium containing program instructions for displaying a three dimensional representation comprising:

computer readable code for changing a first three dimensional view of the three dimensional representation to a second three dimensional view of the three dimensional representation after receiving an input signal indicating movement within the three dimensional representation;

computer readable code for changing a first position of a reference object within a discretely sized two dimensional representation to a second position, the reference object being associated with the three dimensional representation, the first position corresponding to the first three dimensional view and the second position corresponding to the second three dimensional view; and

a computer readable medium that stores the computer codes.

15. A viewer user interface adapted to present information that is organized into a discrete chunk of space to a user, wherein the information potentially includes links and/or objects that are associated with specific locations in the space, the viewer user interface comprising:

a first viewport for presenting a three dimensional representation of the space from the viewpoint of a position within the space; and

a second viewport for presenting information related to at least a portion of the three dimensional representation.

16. A viewer user interface as recited in claim 15 wherein the information within the second viewport is also related to the position within the space.

17. A viewer user interface as recited in claim 15 or 16 wherein the information originates from a URL site on the world wide web.

18. A viewer user interface as recited in claim 15 wherein the information within the second viewport is a secondary 3D representation.

19. A viewer user interface as recited in claim 15 wherein the information within the second viewport is additional information that is not displayed within the first viewport.

20. A viewer user interface as recited in claim 15 wherein the information within the second viewport is selected from a group consisting of streaming video, streaming audio, live video, and live audio.

21. A viewer user interface as recited in claim 15 wherein the information within the second viewport contains at least one control mechanism for controlling aspects of the 3D representation.

22. A viewer user interface as recited in claim 21 wherein at least one of the control mechanisms of the second viewport are arranged to control how the 3D representation is displayed.

23. A viewer user interface as recited in claim 21 wherein at least a one of the control mechanisms is a user controllable interface.

24. A viewer user interface as recited in claim 23 wherein the user controllable interface is selected from a group consisting of a button, a slider, a dial, pull down menu, a entry window, and a switch.

25. A viewer user interface as recited in any of claims 15-24 wherein a size of the first viewport and a size of the second viewport are both configurable.

26. A viewer user interface adapted to present information that is organized into a discrete chunk of space having a plurality of sections to a user, wherein the information potentially includes links and objects including at least some of images, sound clips, video clips and sprites that are associated with specific locations in the space, the viewer user interface comprising:

a first viewport for presenting a three dimensional representation of the space from the viewpoint of a moveable reference position within the space; and

a second viewport for presenting information related to the current reference position.

27. A viewer as recited in claim 26 further comprising a third viewport for presenting a two dimensional birdseye view representation of the discrete chunk of space, the second viewport being arranged to indicate the current reference position.

28. A viewer user interface as recited in claim 27 wherein the information presented within the second viewport is a secondary two dimensional representation.

29. A viewer as recited in any of claims 26-28 further comprising a fourth viewport for presenting a identifier that the discrete chuck of space is associated with.

30. A viewer as recited in claim 29 wherein the identifier is user configurable.

31. A viewer as recited in claim 29 wherein the identifier is nonalterable by a user.

32. A viewer as recited in any of claims 26-31 further comprising an entry bar arranged to identify the discrete chunk of space that the first and second viewports are presenting.

33. A viewer as recited in any of claims 26-32 further comprising a local link viewer arranged to identify links in selected locations that are adjacent to the current reference position; and

34. A viewer as recited in any of claims 26-33 further comprising a status box arranged to present status information.

35. A viewer as recited in any of claims 26-34 further comprising an advertising window to present advertisement information.

36. A viewer as recited in claim 35 wherein the advertisement information originates from a URL site.

37. A viewer as recited in claim 35 wherein the URL site is selectable by a user.

38. A viewer as recited in claim 35 wherein the URL site is fixed such that a user is prohibited from replacing the URL site with another URL site.

39. A method of displaying a three dimensional representation and related information, comprising:

displaying a first portion of the three dimensional representation within a first viewport;

displaying a first set of information related to the first portion of the three dimensional representation;

displaying a second portion of the three dimensional representation within the first viewport in response to receiving an input signal indicating movement within the three dimensional representation; and

displaying a second set of information related to the second portion of the three dimension representation.

40. A method as recited in claim 39, further comprising displaying names of links that are proximate to the second three dimensional view within a third viewport.

41. A method as recited in claims 39 or 40, further comprising:

displaying a hierarchical list of related three dimensional representations after receiving an input signal indicating selection of the hierarchical list, wherein the currently displayed three dimensional representation is displayed within the hierarchical list; and

displaying a list of links associated with the currently displayed three dimensional representation after receiving an input signal indicating selection of the associated links.

42. A method as recited in claim 41, further comprising activating a selected link after receiving an input signal indicating selection of the link, wherein the link is selected from the displayed hierarchical list.

43. A method as recited in claim 41, further comprising activating a selected link after receiving an input signal indicating selection of the link

44. A method as recited in any of claims 39-43 further comprising changing a display characteristic of the currently displayed portion of the three dimensional representation after receiving an input from a source of the information indicating modification of the display characteristic.

45. A method as recited in claim 44 wherein the source is a URL address.

46. A display system for displaying a three dimensional world, comprising:

a three dimensional display window arranged to output at least a portion of the three dimensional world; and

a web display window arranged to output a web page corresponding to at least the portion of the three dimensional world output in the three dimensional display window.

47. A display system as recited in claim 46 further comprising a two dimensional display window arranged to output a two dimensional representation of the three dimensional world that includes a position indicator associated with the portion of the three dimensional world that is displayed in the three dimensional display window.

48. A computer readable medium containing program instructions for displaying a three dimensional representation and related information, comprising:

computer readable code for displaying a first portion of the three dimensional representation within a first viewport;

computer readable code for displaying a first set of information related to the first portion of the three dimensional representation;

computer readable code for displaying a second portion of the three dimensional representation within the first viewport in response to receiving an input signal indicating movement within the three dimensional representation; and

computer readable code for displaying a second set of information related to the second portion of the three dimension representation; and

a computer readable medium that stores the computer codes.

49. A method of displaying a security token within a displayed output of an audiovisual display generator, the method comprising:

encrypting a user phrase, the user phrase identifying a user of the audiovisual display generator;

adding encrypted phrase to a token list;

selecting the encrypted phrase from the token list;

decrypting the user phrase from the encrypted phrase; and

displaying the user phrase within the displayed output of the audiovisual generator such that the user of the audiovisual display generator is identified.

50. A method as recited in claim 49 wherein the encrypted user phrase is automatically selected by the audiovisual generator such that the user is prohibited from altering the user phrase.

51. A method as recited in claim 49 wherein the encrypted user phrase is selectable by the user.

52. A method as recited in claim 51 wherein the encrypted user phrase is associated with a human readable phrase so as to facilitate user selection of the encrypted user phrase.

53. A method as recited in any of claims 49-52 wherein the user phrase is displayed within a caption bar of the displayed output.

54. A method as recited in any of claims 49-53 further comprising determining whether the decrypted user phrase is valid and wherein the user phrase is only displayed when it is valid.

55. A method as recited in claim 54 wherein the validity determination is based on whether or not the decrypted user phrase matches the encrypted user phrase or has been altered since being encrypted.

56. A method as recited in claim 54 further comprising matching the user phrase with a serial number of the audiovisual display generator and wherein the validity determination is based on whether or not the serial number of the audiovisual display generator matches the decrypted user phrase.

57. A computer readable medium containing program instructions for displaying a security token within a displayed output of an audiovisual display generator, the computer readable medium comprising:

computer code for encrypting a user phrase, the user phrase identifying a user of the audiovisual display generator;

computer code for adding encrypted phrase to a token list;

computer code for selecting the encrypted phrase from the token list;

computer code for decrypting the user phrase from the encrypted phrase;

computer code for displaying the user phrase within the displayed output of the audiovisual generator such that the user of the audiovisual display generator is identified; and

a computer readable medium that stores the computer codes.

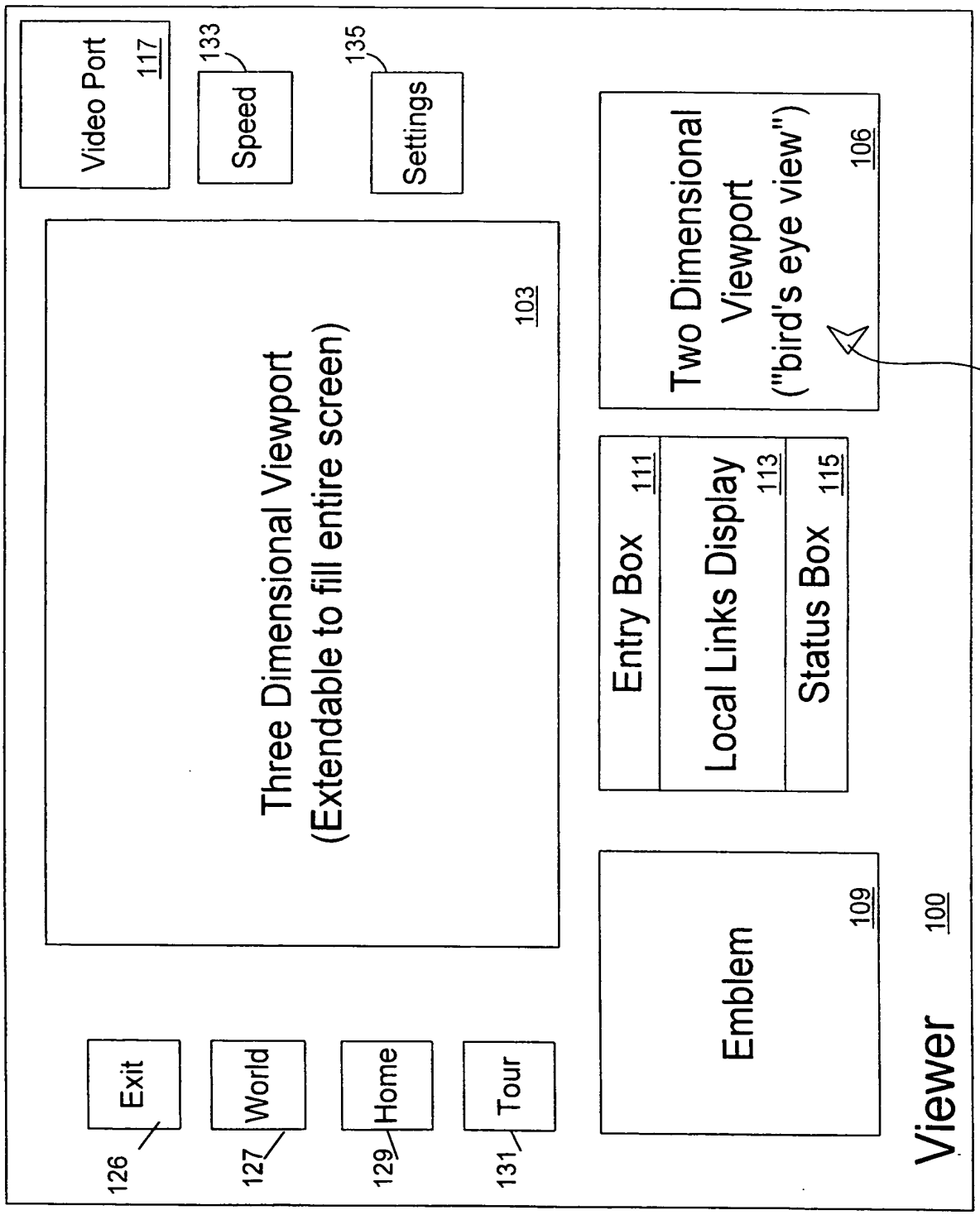
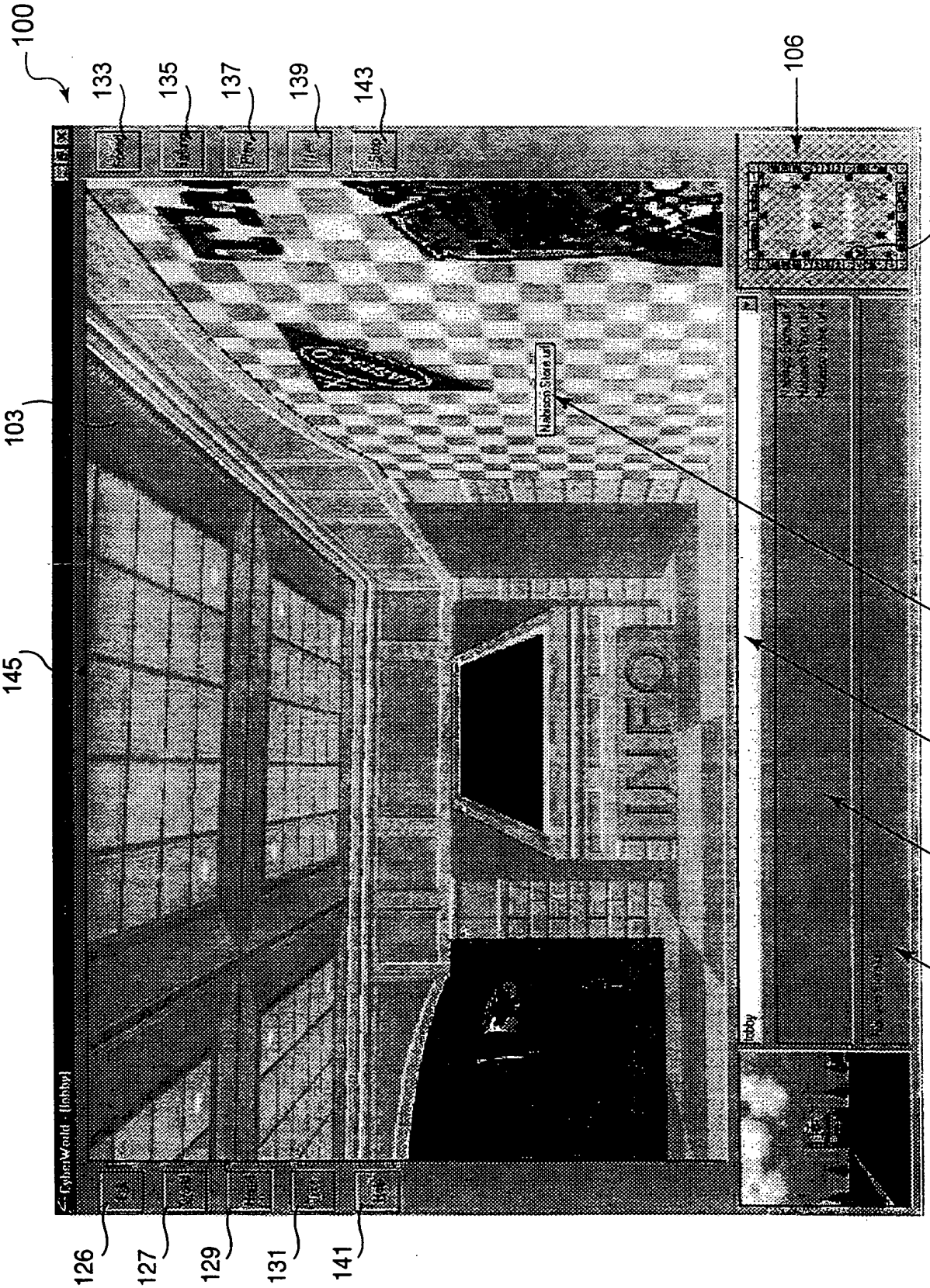


Figure 1



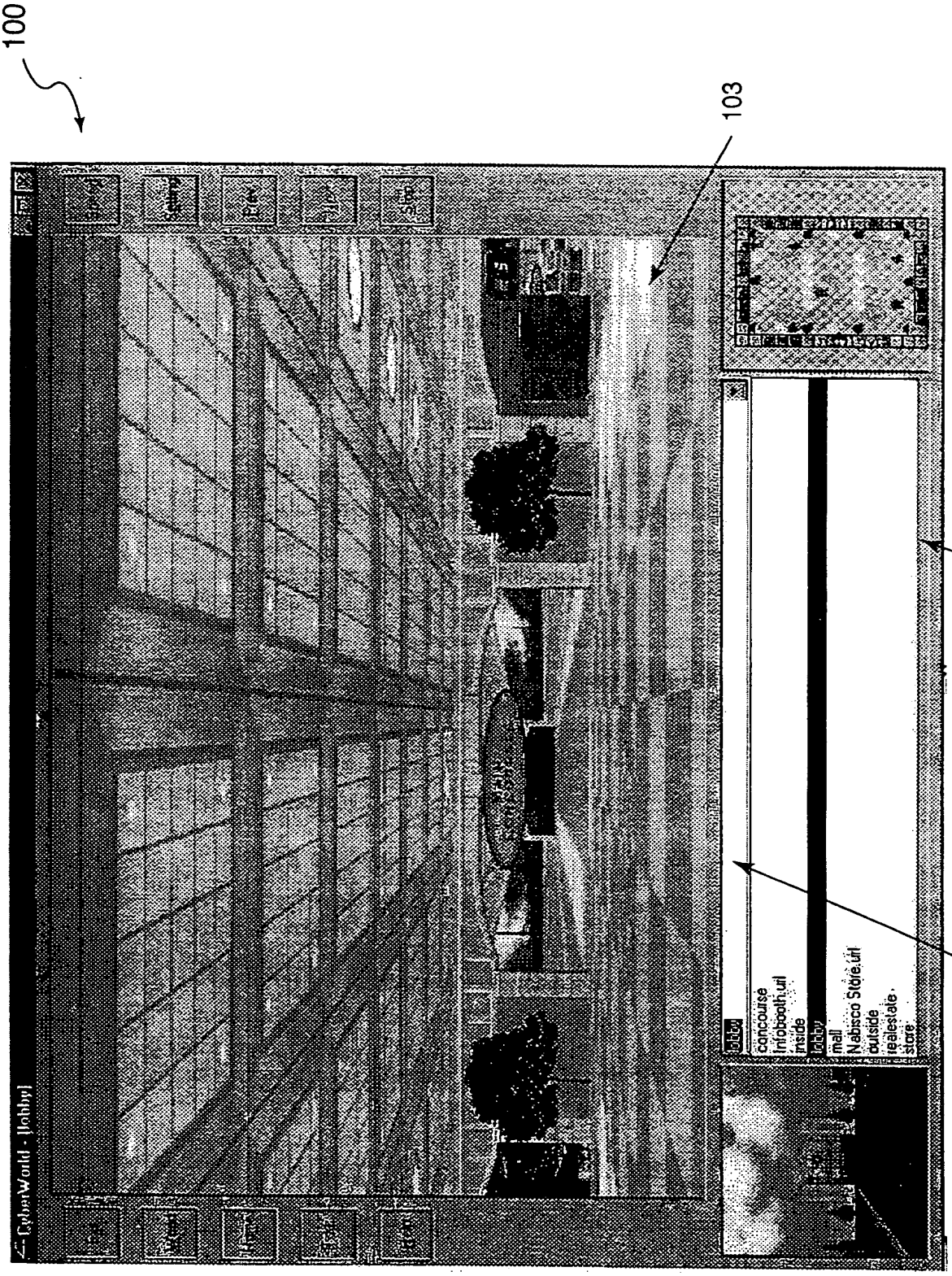

100
103
302
111
CyberWorld - [lobby]
concourse
infobooth.url
inside
lobby
mall
Nabisco Store.url
outside
realestate
store

Figure 3

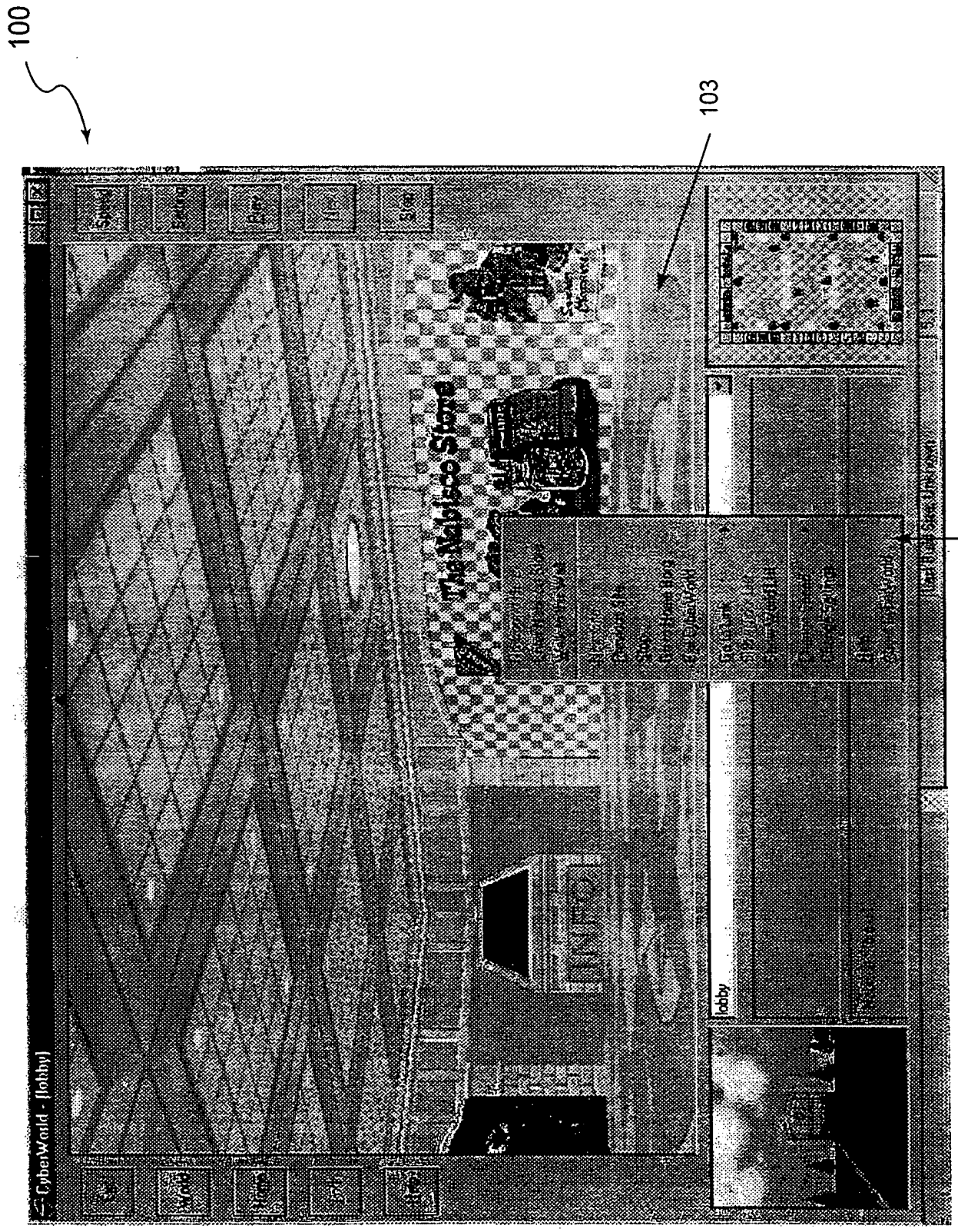


Figure 4

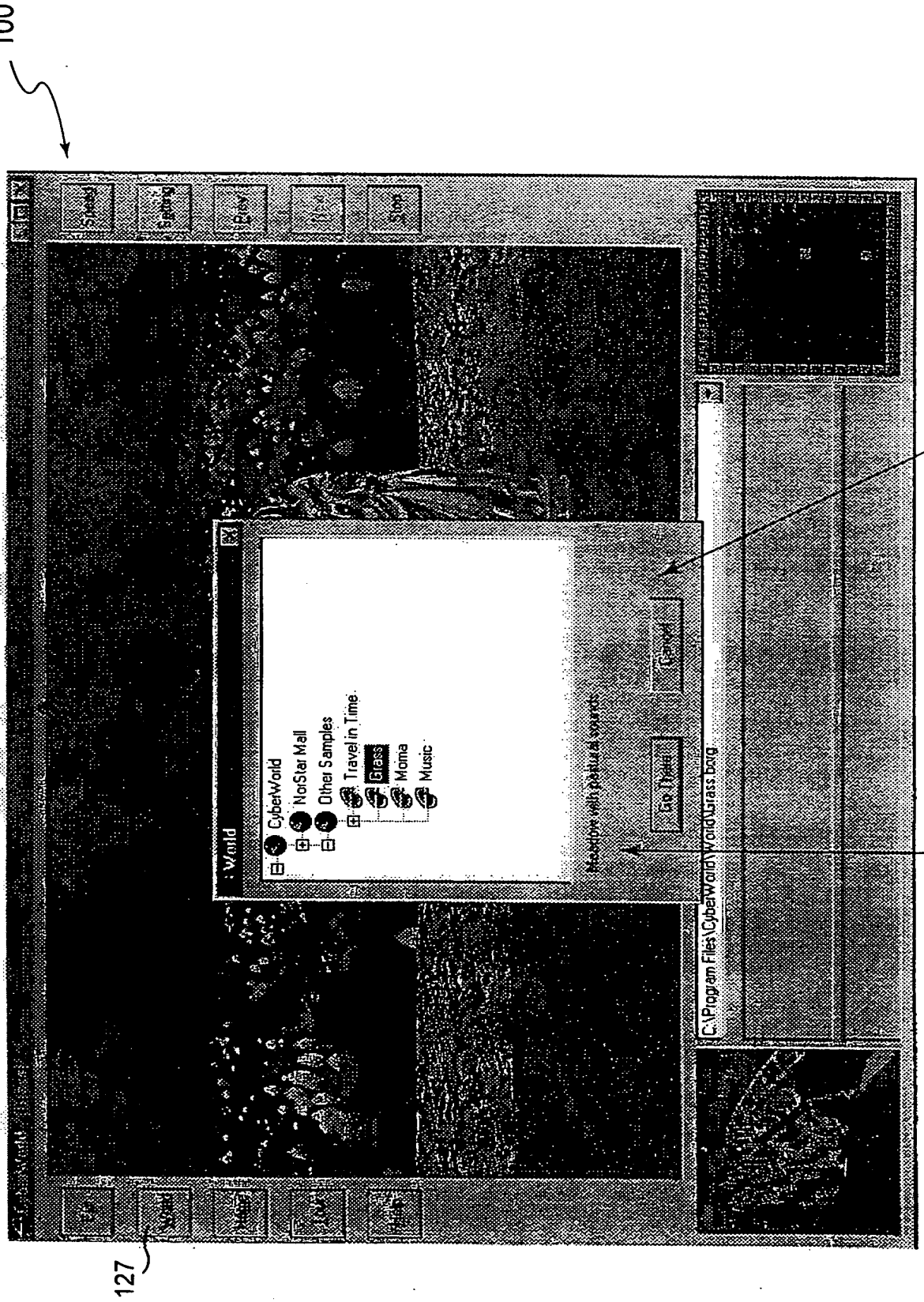


Figure 5

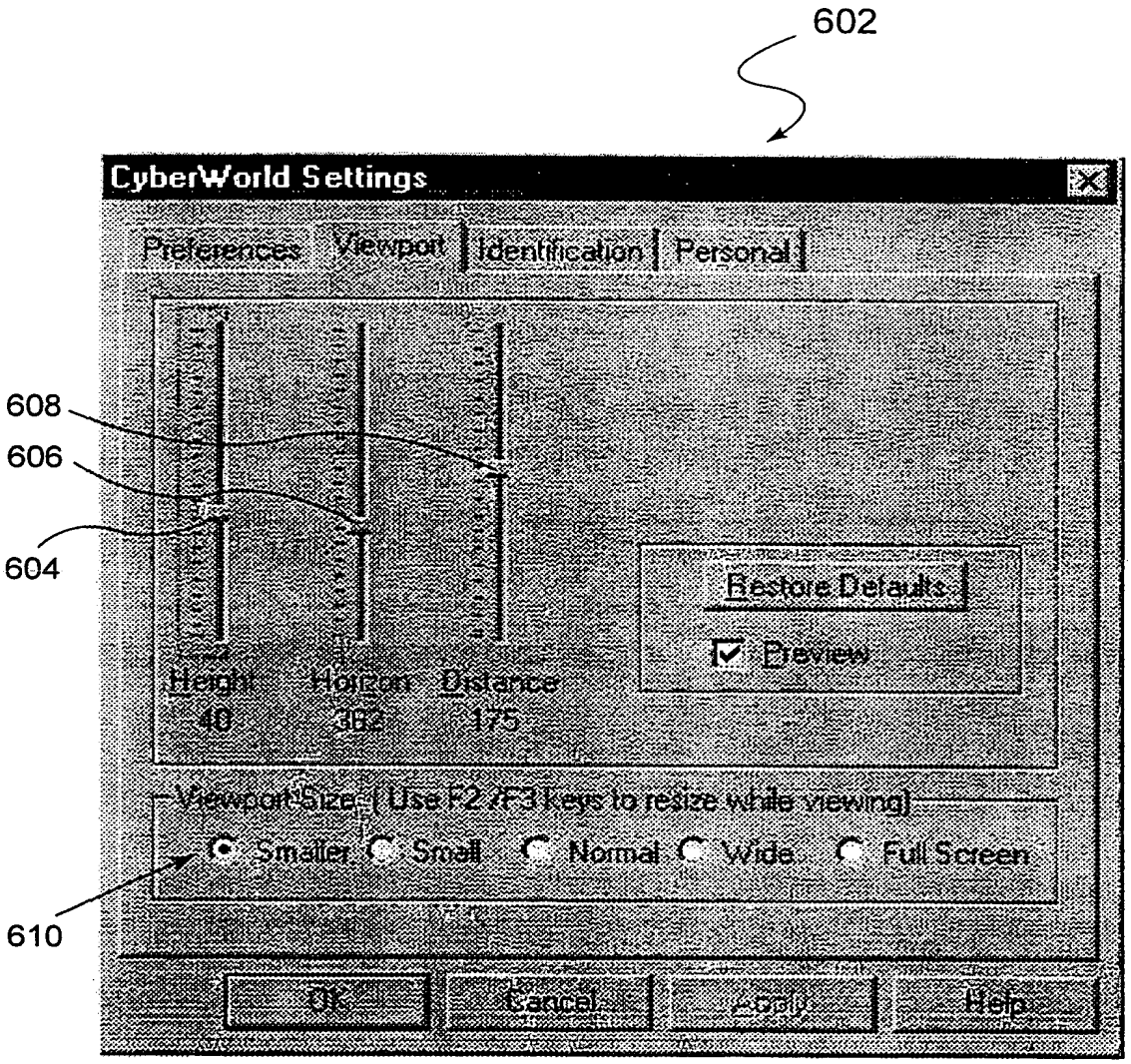

602
CyberWorld Settings
Preferences
Viewport
Identification
Personal
608
606
604
Restore Defaults
Preview
Height
40
Horizon
362
Distance
175
Viewport Size (Use F2/F3 keys to resize while viewing)
Smaller
Small
Normal
Wide
Full Screen
610
OK
Cancel
Apply
Help

Figure 6

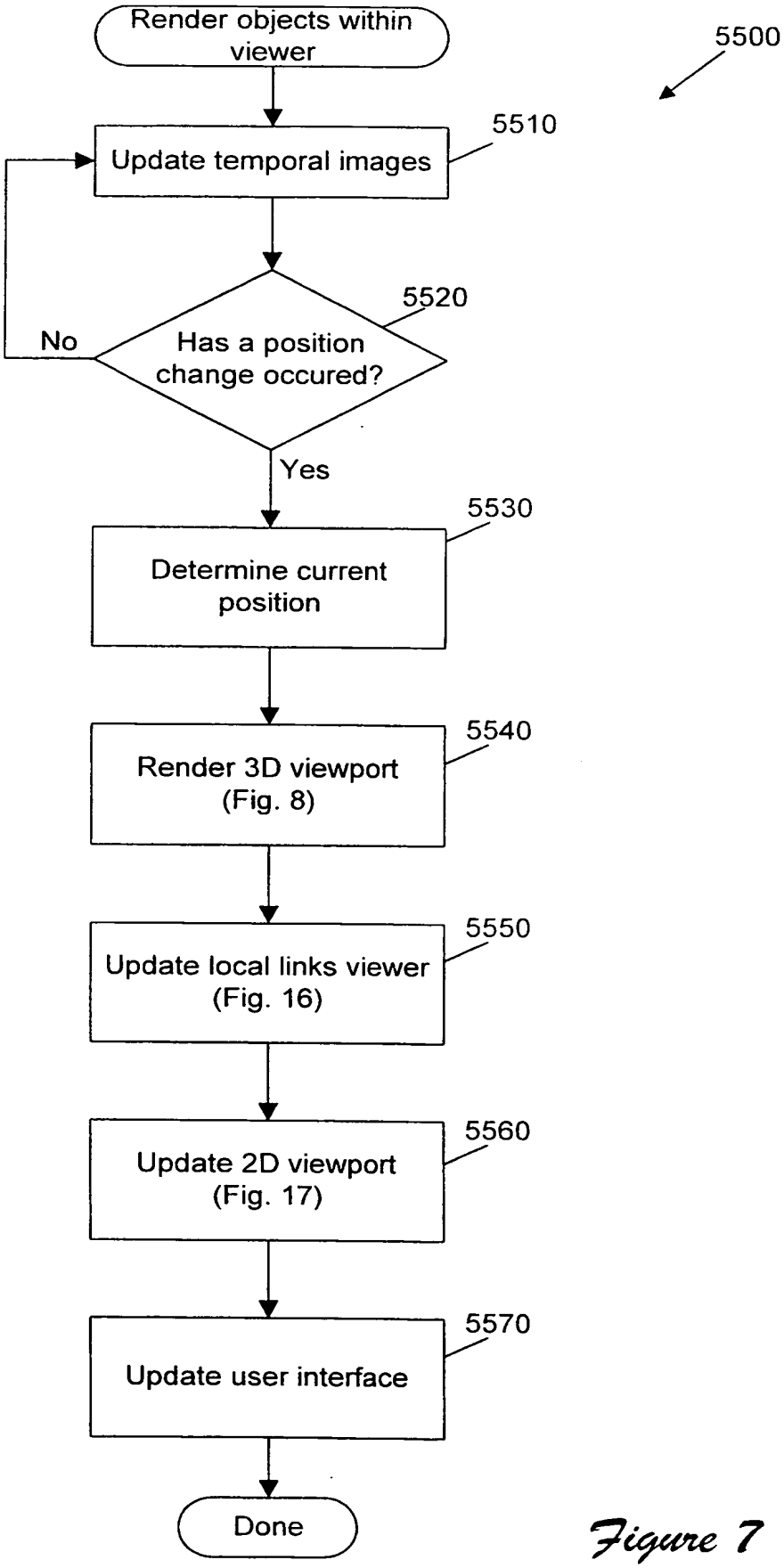


Figure 7

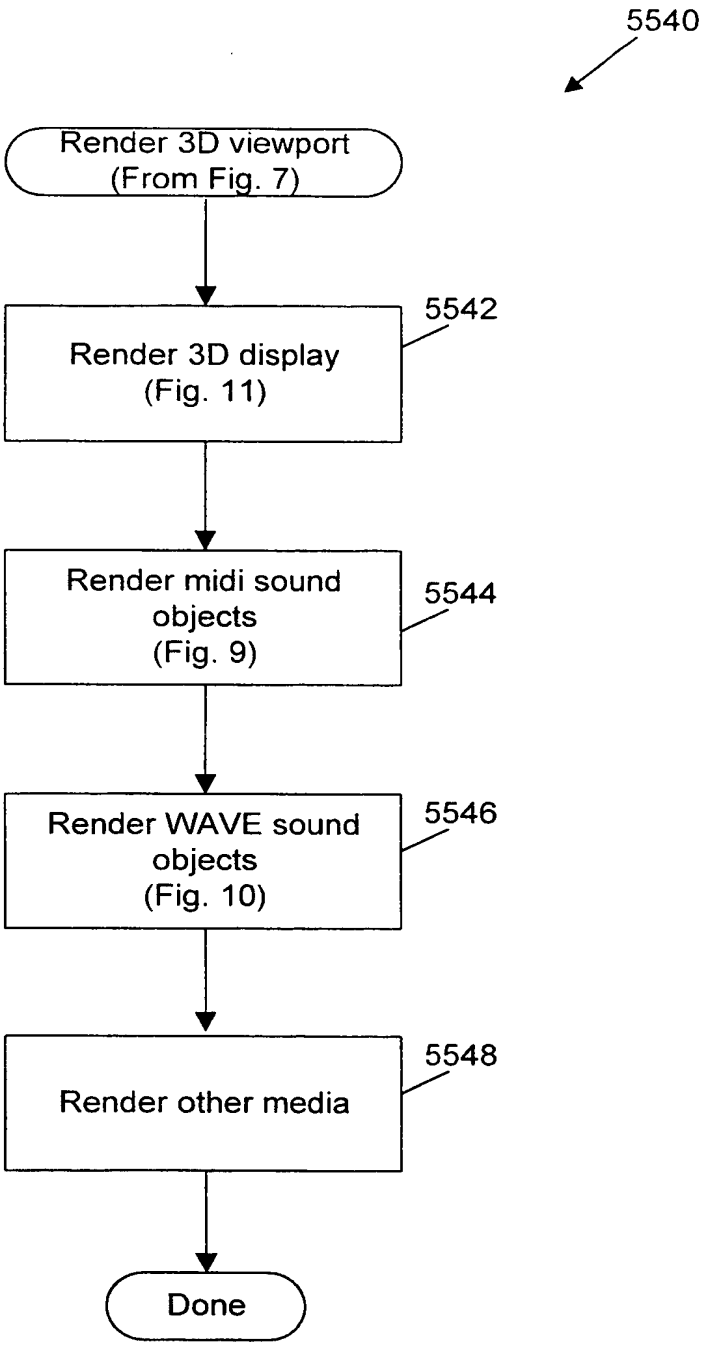

5540
Render 3D viewport (From Fig. 7)
5542
Render 3D display (Fig. 11)
5544
Render midi sound objects (Fig. 9)
5546
Render WAVE sound objects (Fig. 10)
5548
Render other media
Done

Figure 8

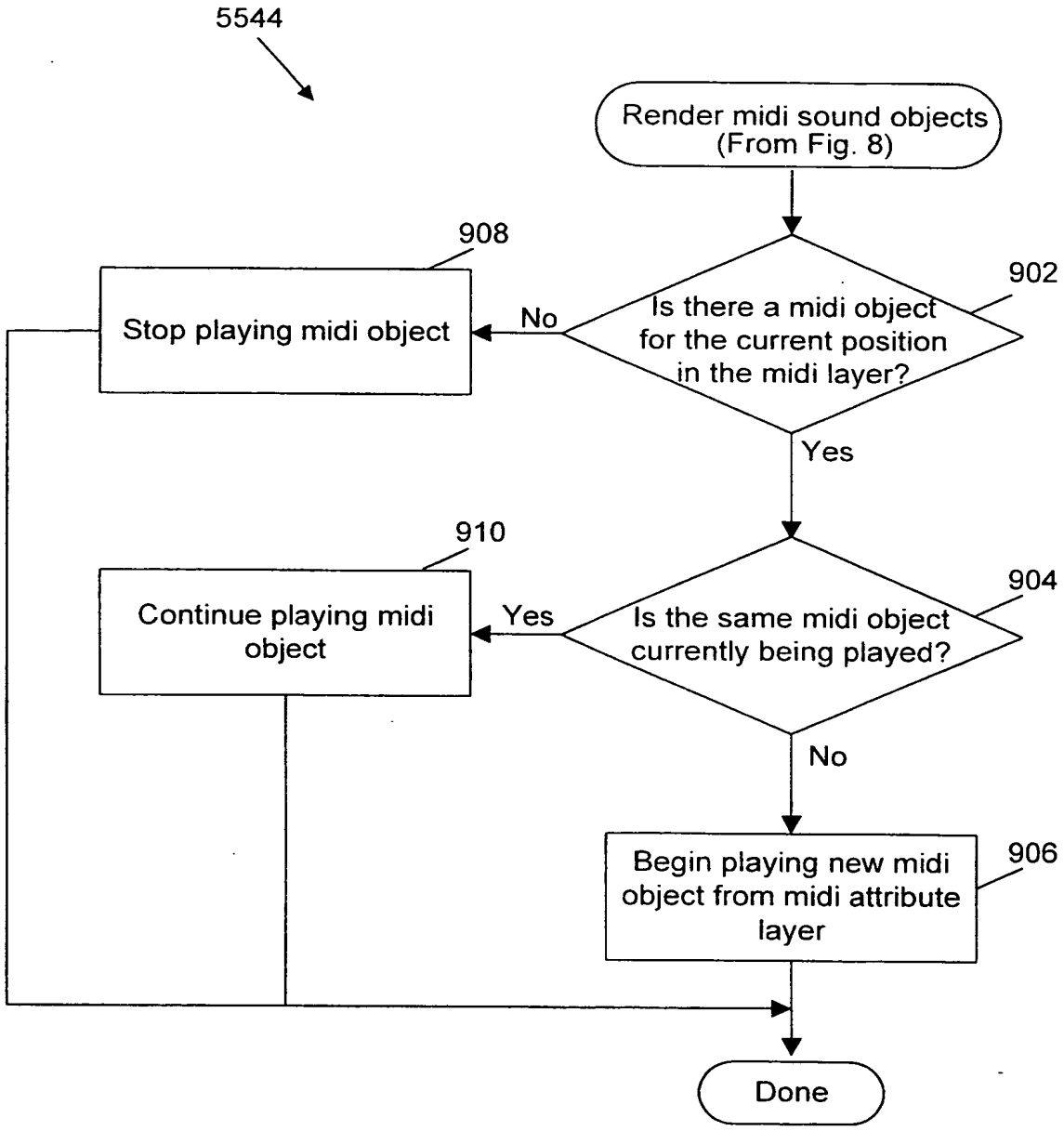


Figure 9

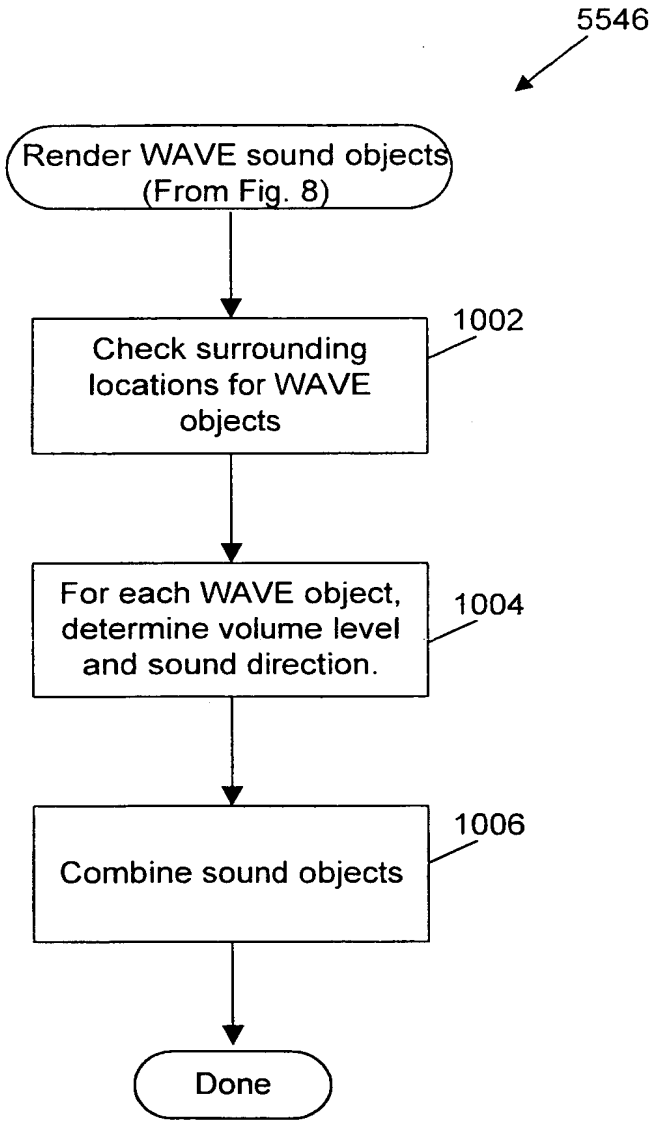


Figure 10

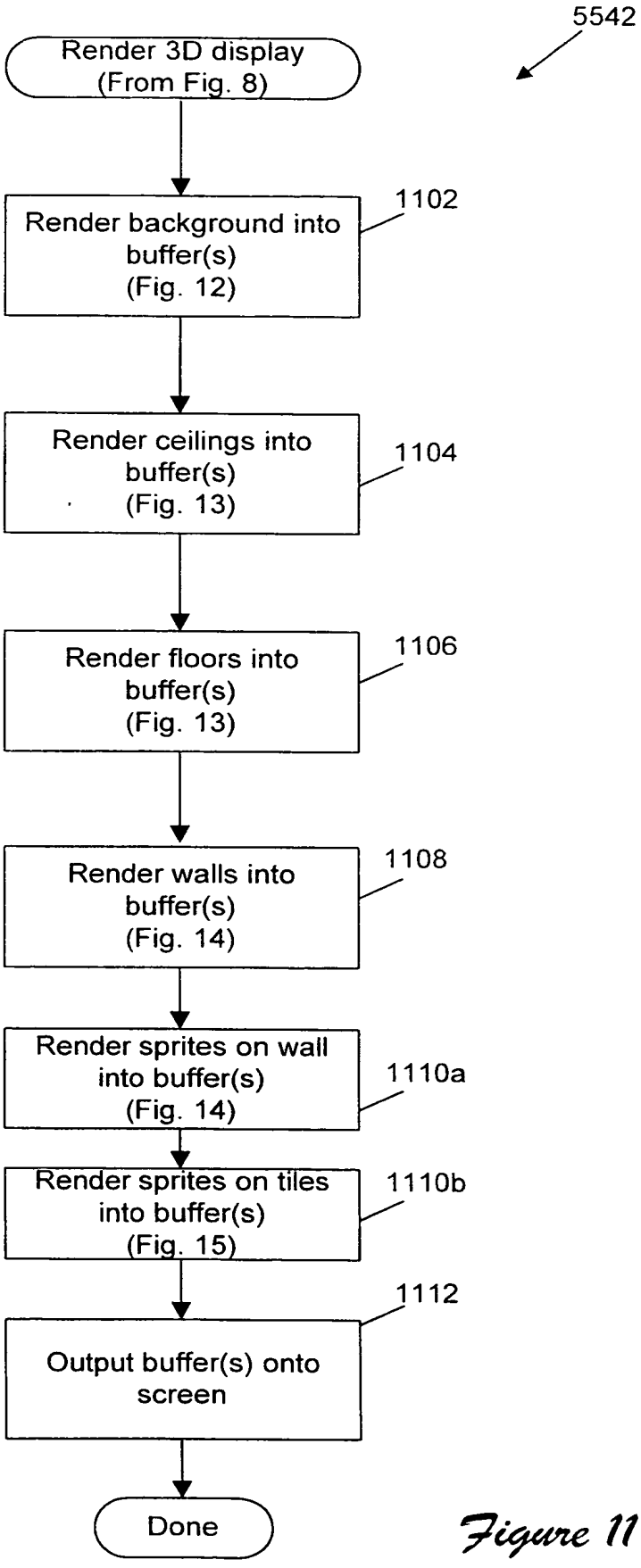

5542
Render 3D display (From Fig. 8)
Render background into buffer(s) (Fig. 12)
1102
Render ceilings into buffer(s) (Fig. 13)
1104
Render floors into buffer(s) (Fig. 13)
1106
Render walls into buffer(s) (Fig. 14)
1108
Render sprites on wall into buffer(s) (Fig. 14)
1110a
Render sprites on tiles into buffer(s) (Fig. 15)
1110b
Output buffer(s) onto screen
1112
Done

Figure 11

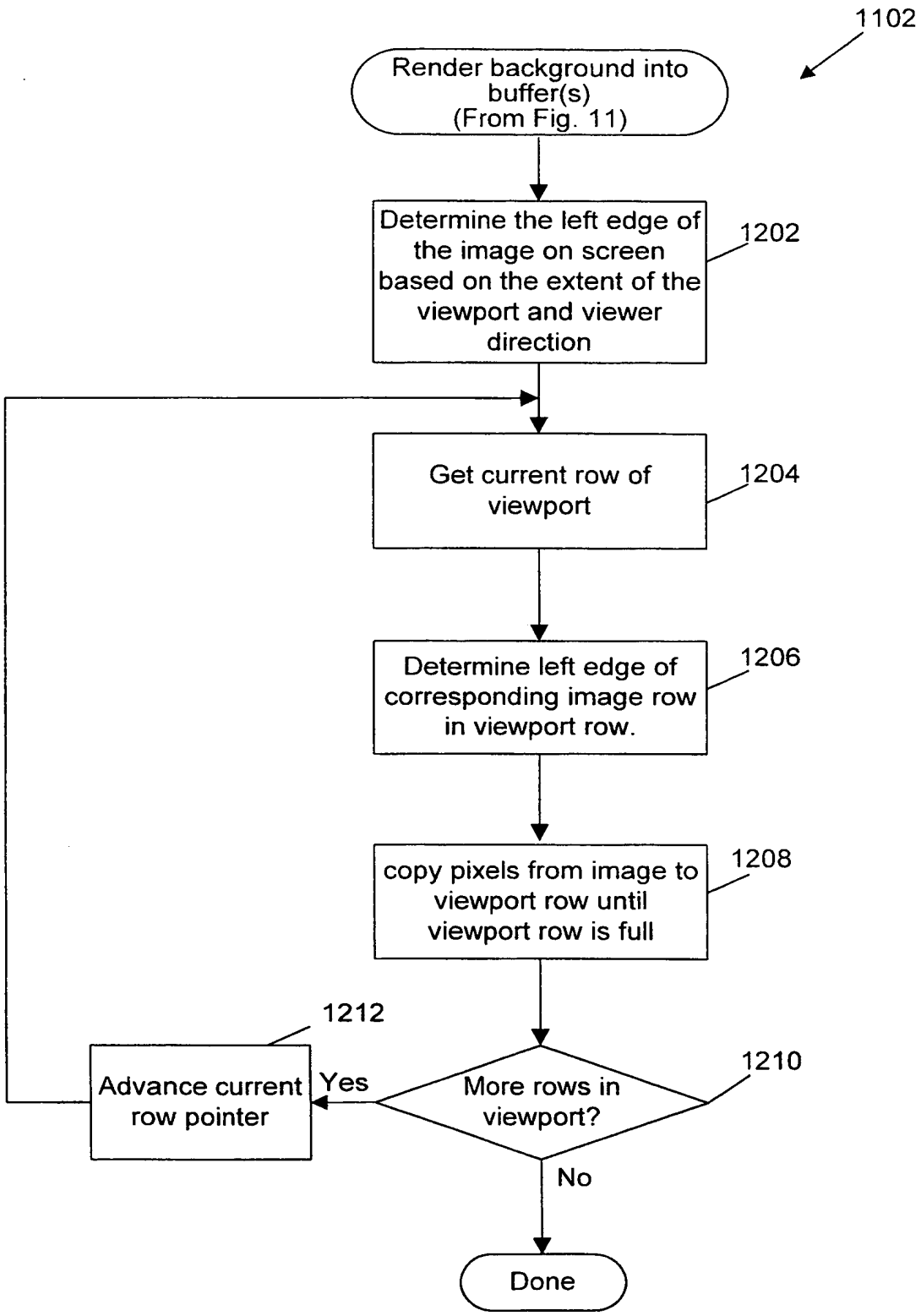

1102
Render background into buffer(s) (From Fig. 11)
Determine the left edge of the image on screen based on the extent of the viewport and viewer direction
1202
Get current row of viewport
1204
Determine left edge of corresponding image row in viewport row.
1206
copy pixels from image to viewport row until viewport row is full
1208
1212
Advance current row pointer
Yes
More rows in viewport?
1210
No
Done

Figure 12

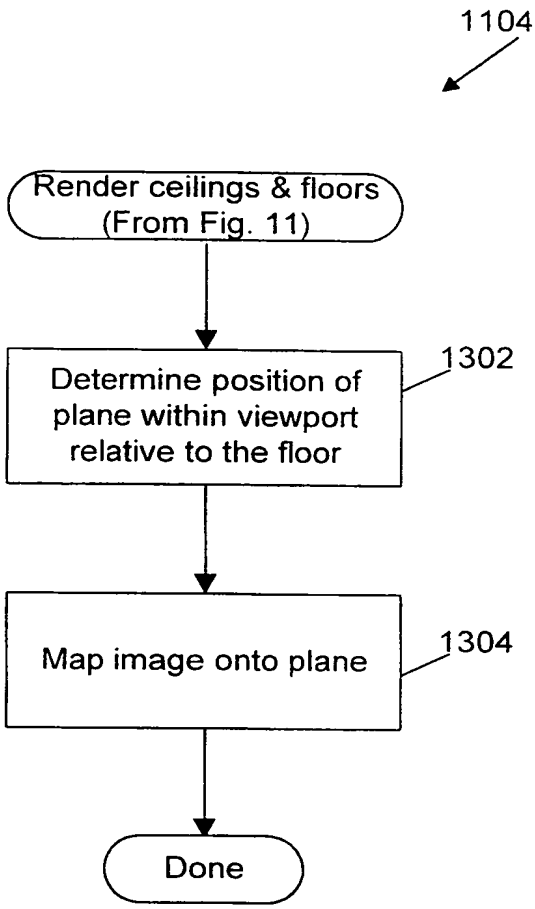


Figure 13

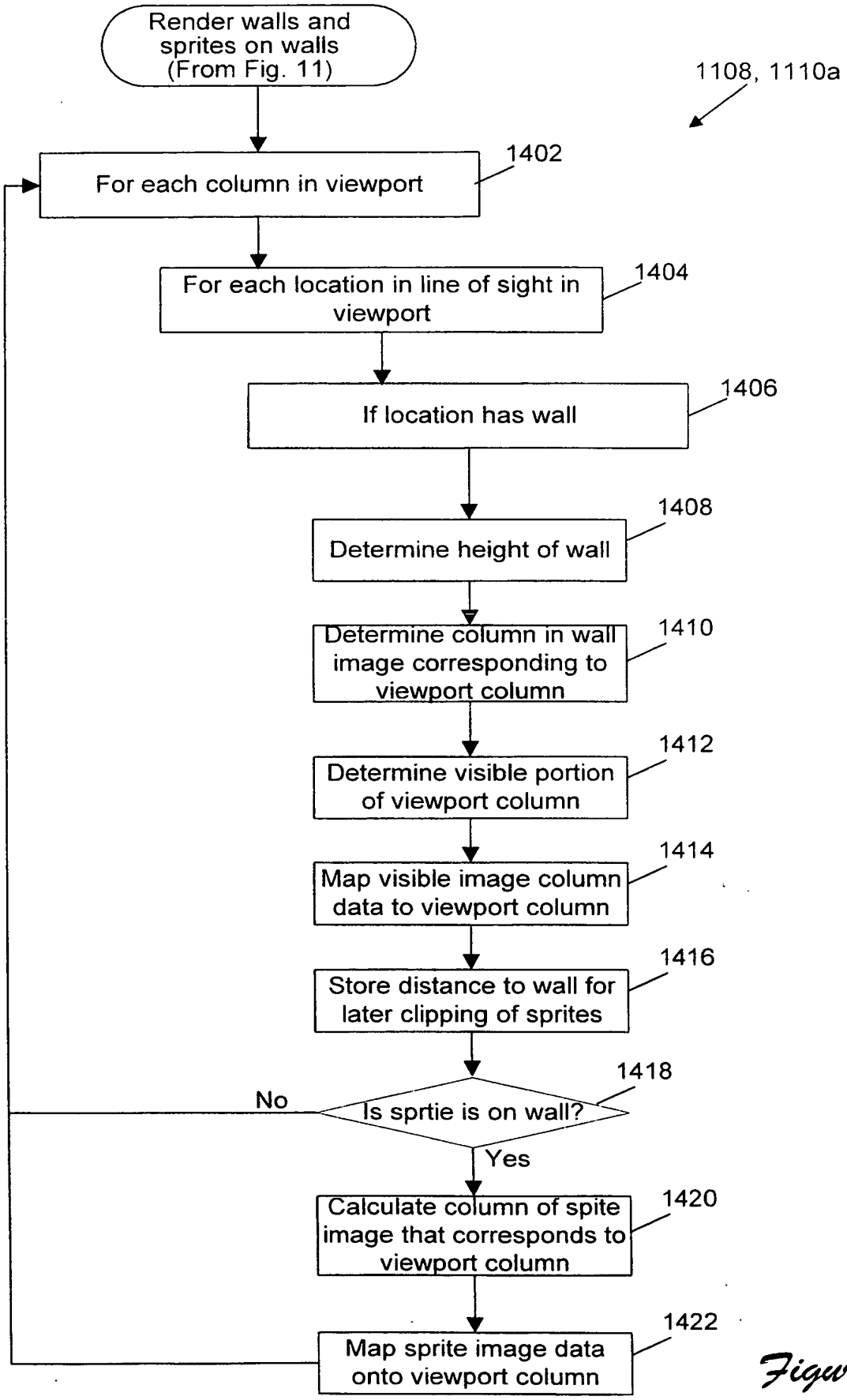

Render walls and sprites on walls (From Fig. 11)
1108, 1110a
For each column in viewport
1402
For each location in line of sight in viewport
1404
If location has wall
1406
Determine height of wall
1408
Determine column in wall image corresponding to viewport column
1410
Determine visible portion of viewport column
1412
Map visible image column data to viewport column
1414
Store distance to wall for later clipping of sprites
1416
Is sprtie is on wall?
1418
No
Yes
Calculate column of spite image that corresponds to viewport column
1420
Map sprite image data onto viewport column
1422

Figure 14

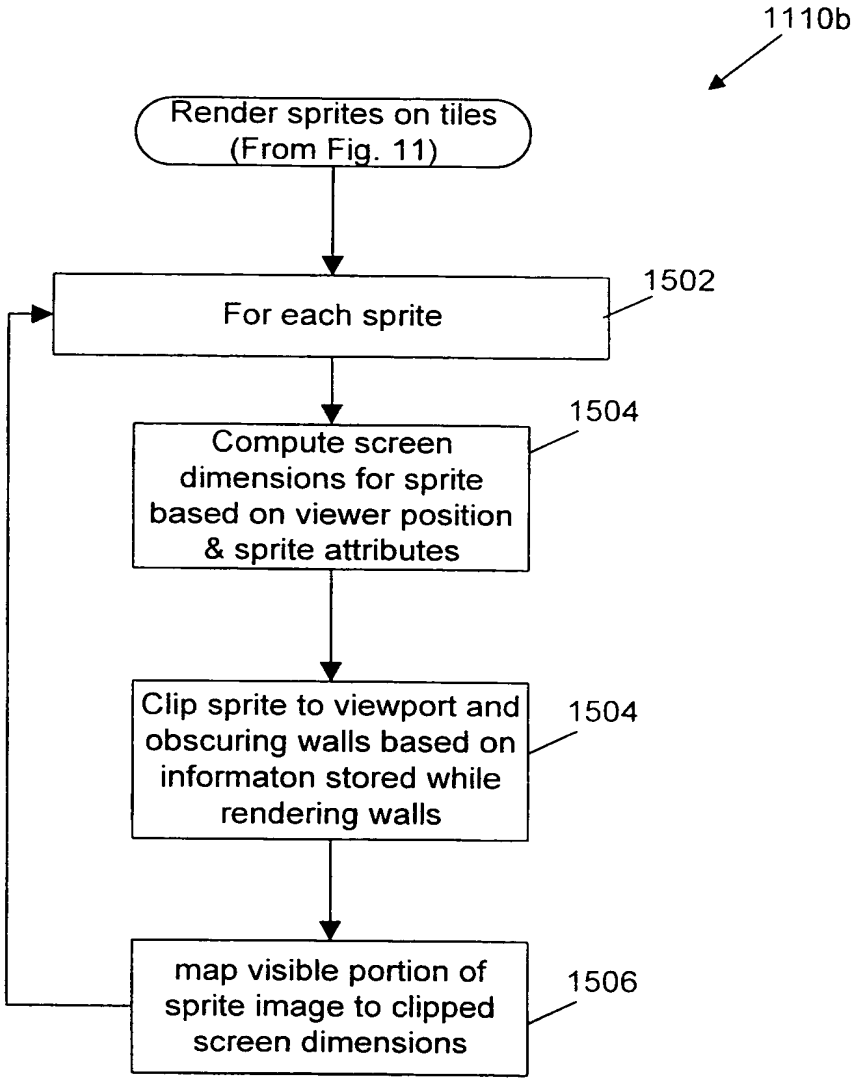


Figure 15

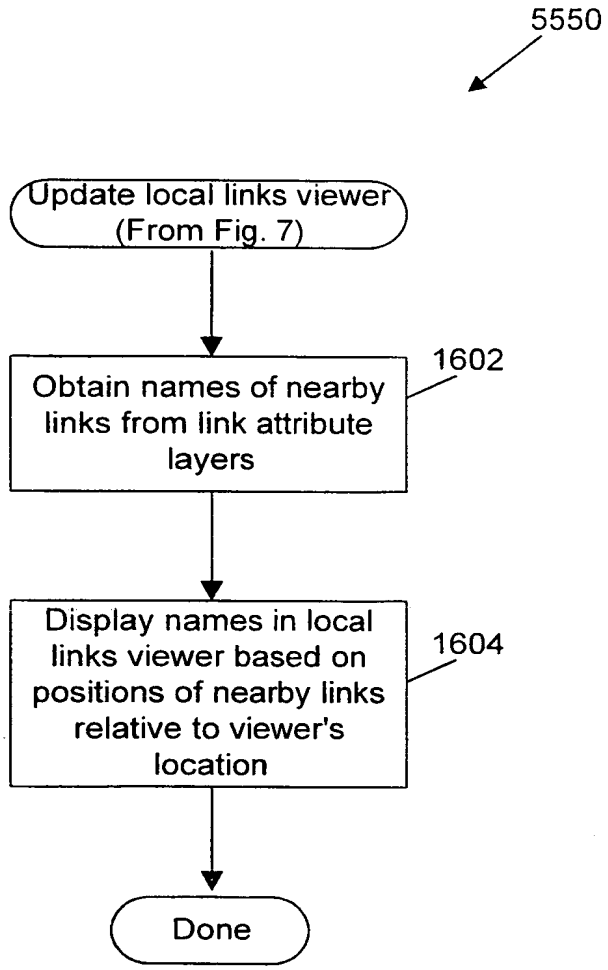

5550
Update local links viewer (From Fig. 7)
Obtain names of nearby links from link attribute layers
1602
Display names in local links viewer based on positions of nearby links relative to viewer's location
1604
Done

Figure 16

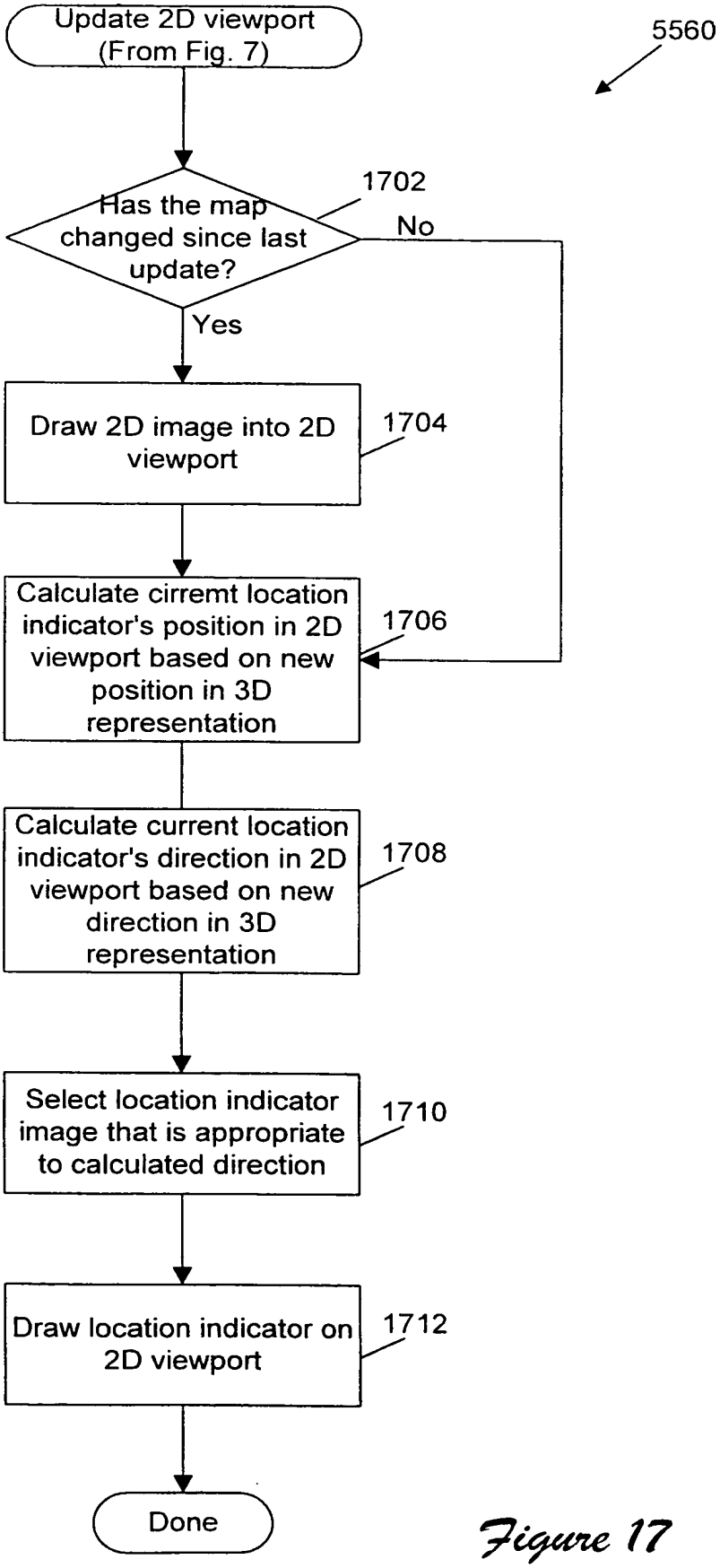

Update 2D viewport (From Fig. 7)
5560
Has the map changed since last update?
1702
No
Yes
Draw 2D image into 2D viewport
1704
Calculate cirremt location indicator's position in 2D viewport based on new position in 3D representation
1706
Calculate current location indicator's direction in 2D viewport based on new direction in 3D representation
1708
Select location indicator image that is appropriate to calculated direction
1710
Draw location indicator on 2D viewport
1712
Done

Figure 17

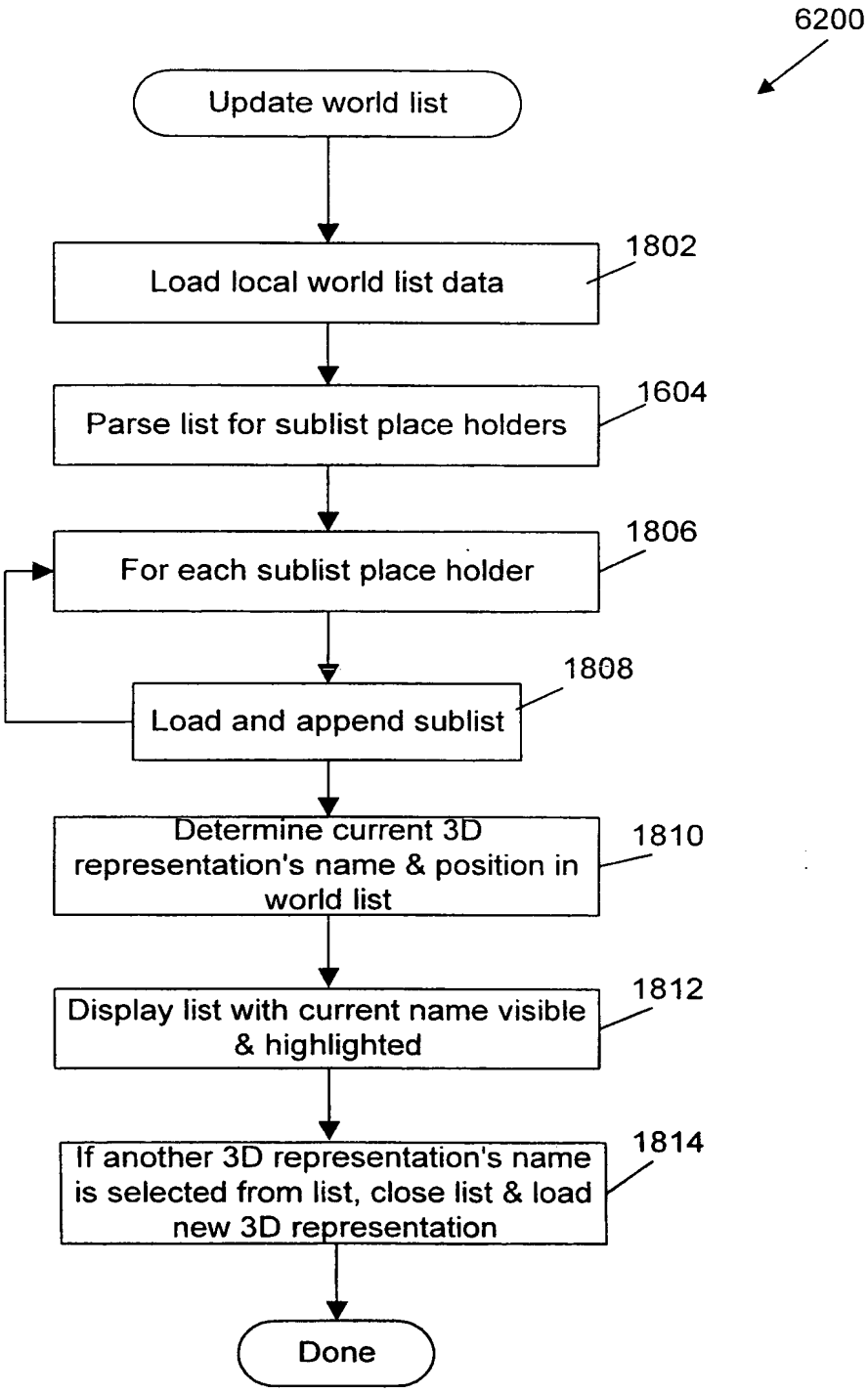


Figure 18

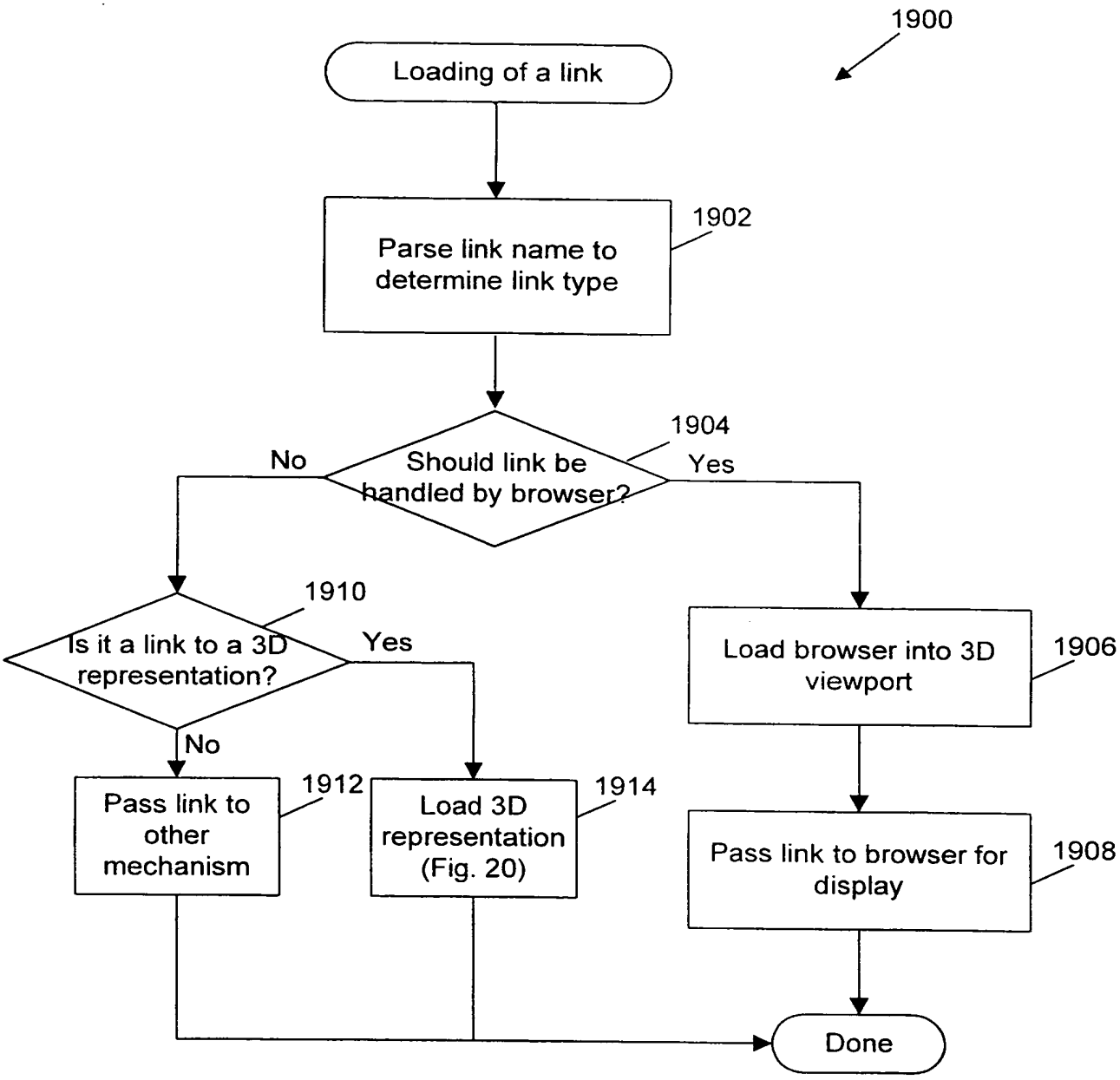


Figure 19

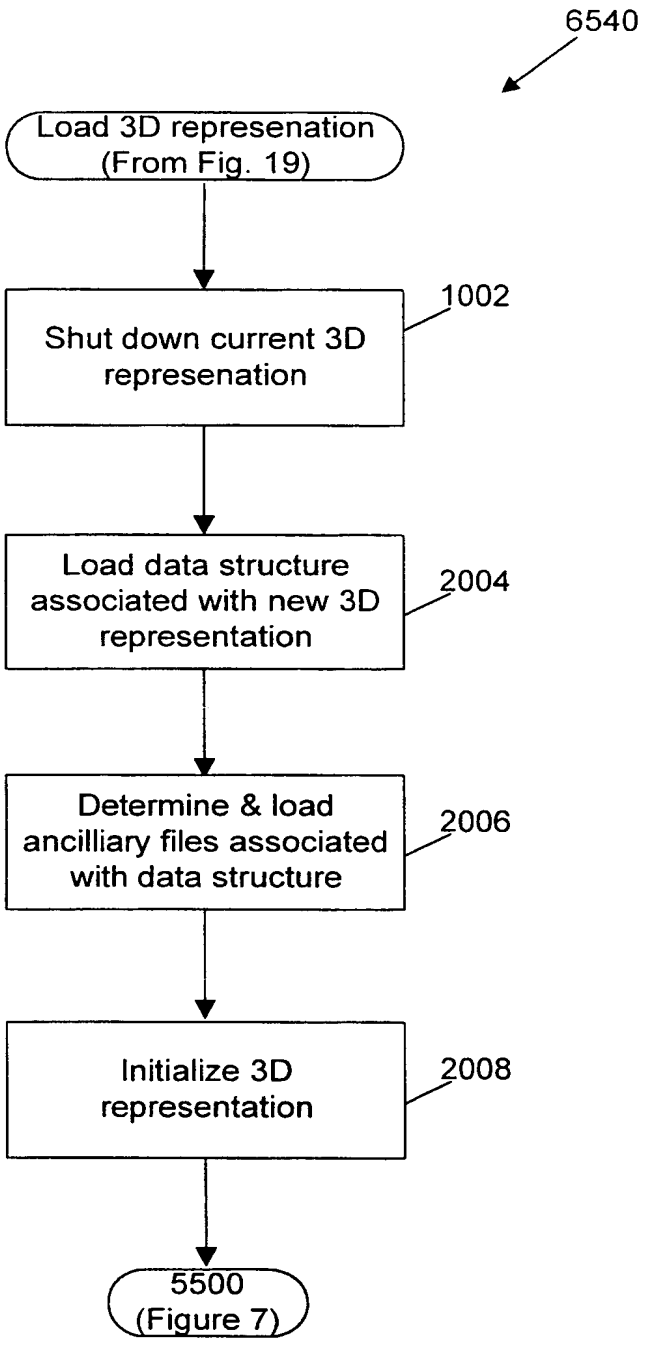


Figure 20

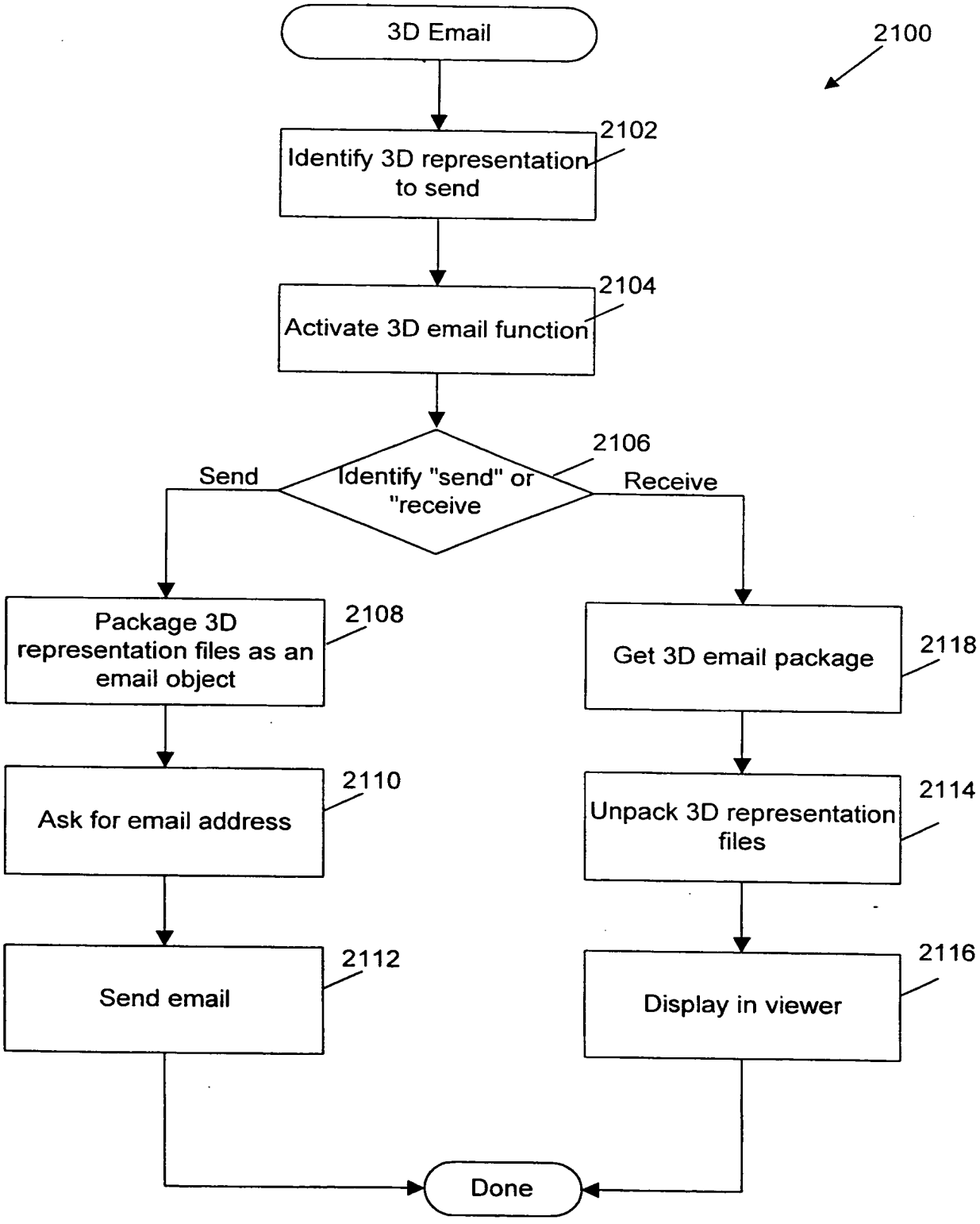


Figure 21

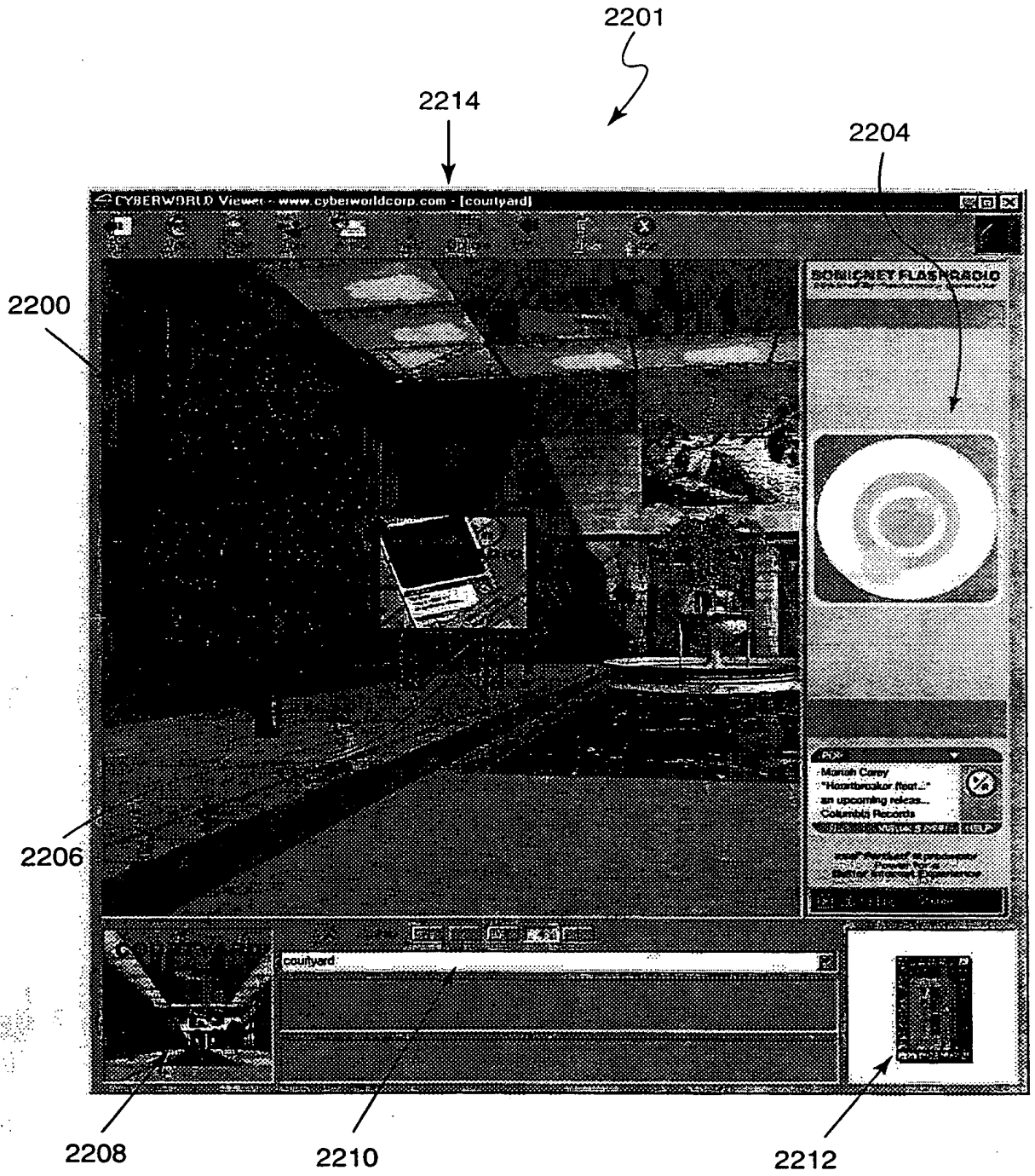


Figure 22

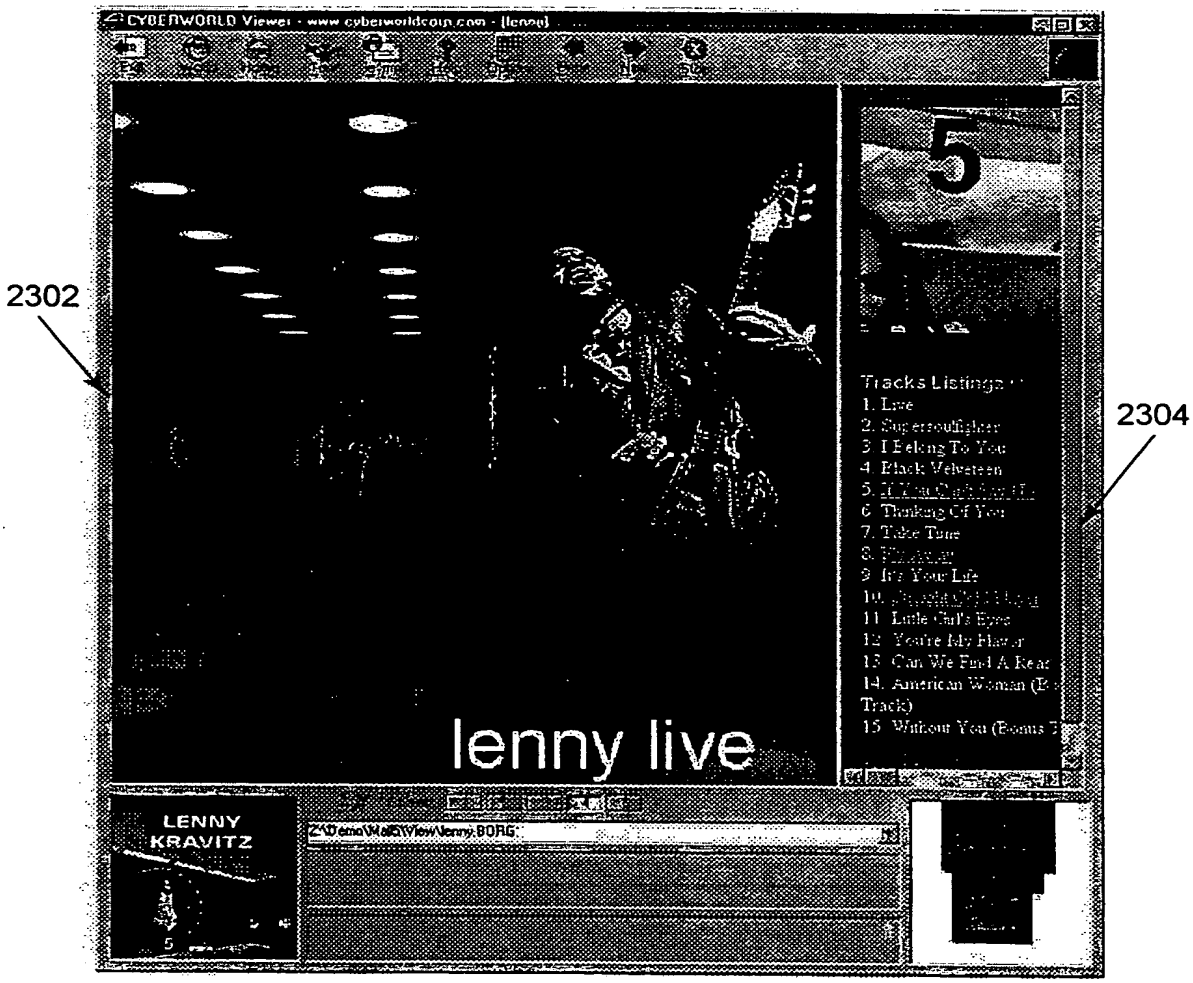

2302
2304
lenny live
LENNY KRAVITZ
Tracks Listings
1. Live
2. Supersoulfighter
3. I Belong To You
4. Black Velveteen
6. Thinking Of You
7. Take Time
9. It's Your Life
11. Little Girl's Eyes
12. You're My Flavor
13. Can We Find A Reas
14. American Woman (B
Track)
15. Without You (Bonus

Figure 23

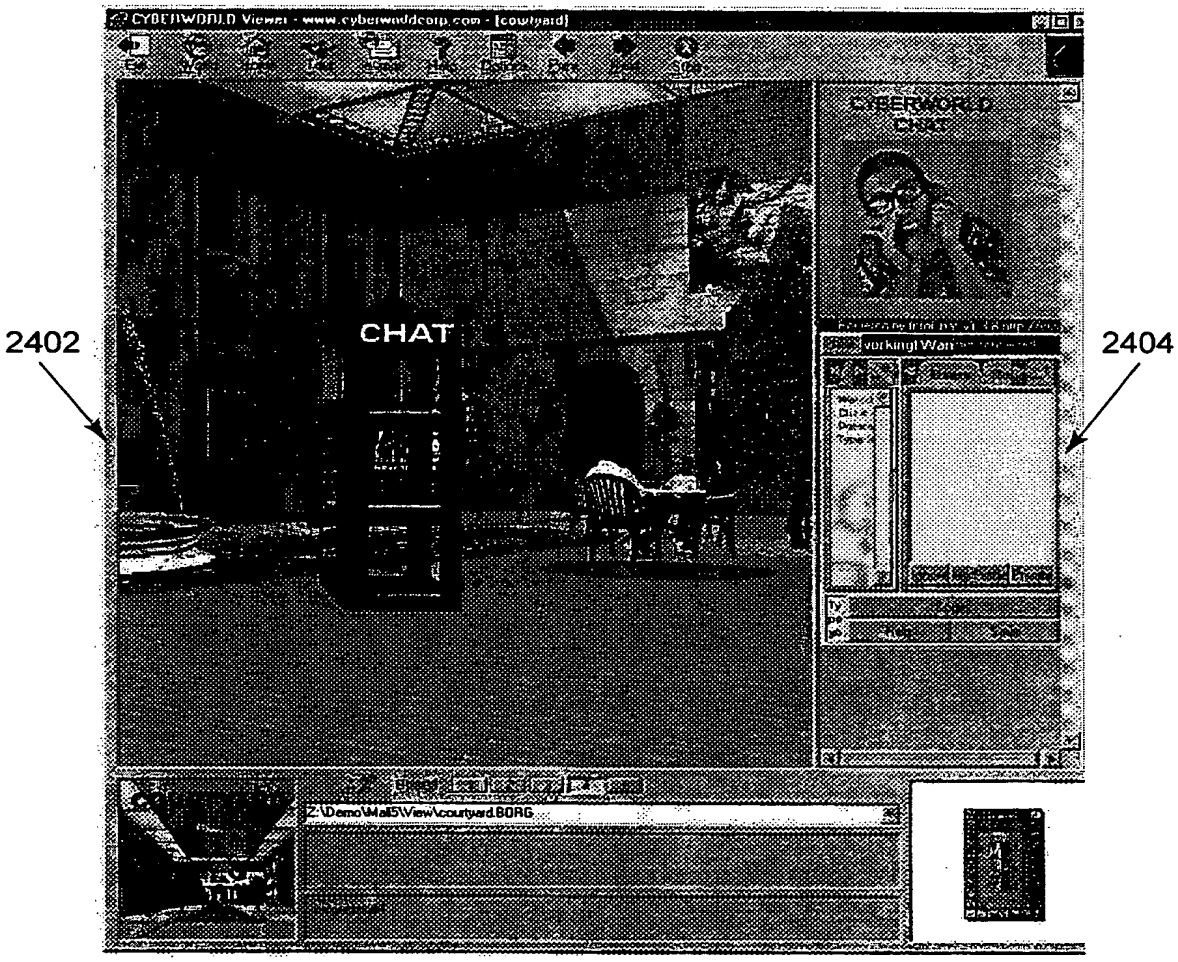


Figure 24

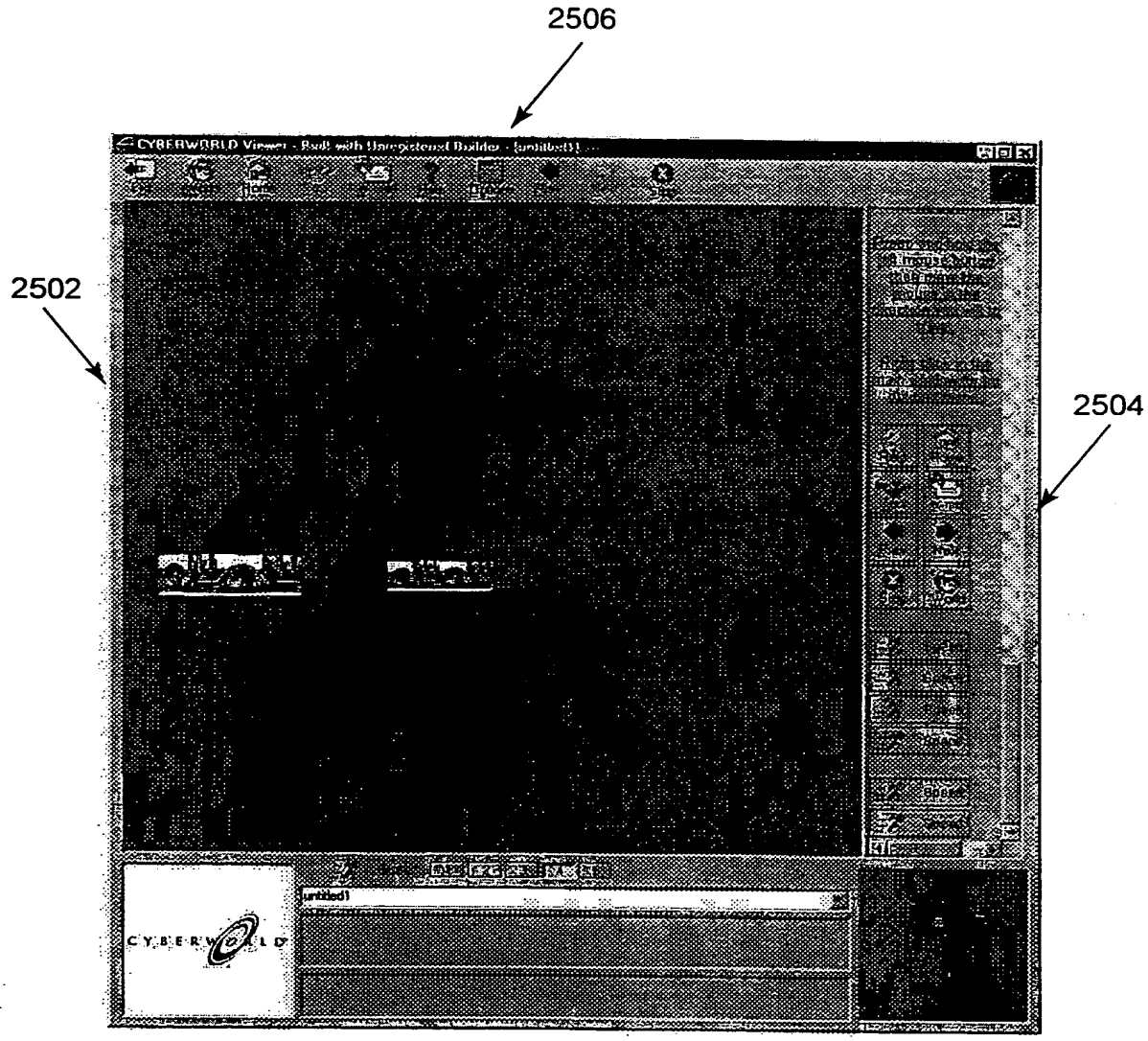


Figure 25


2602
2604
NINE WEST
shop online by category:
shoes
handbags
accessories
quantity
add to bag
click to view contents
items 0, $0.00
NINE WEST
NINE WEST

Figure 26

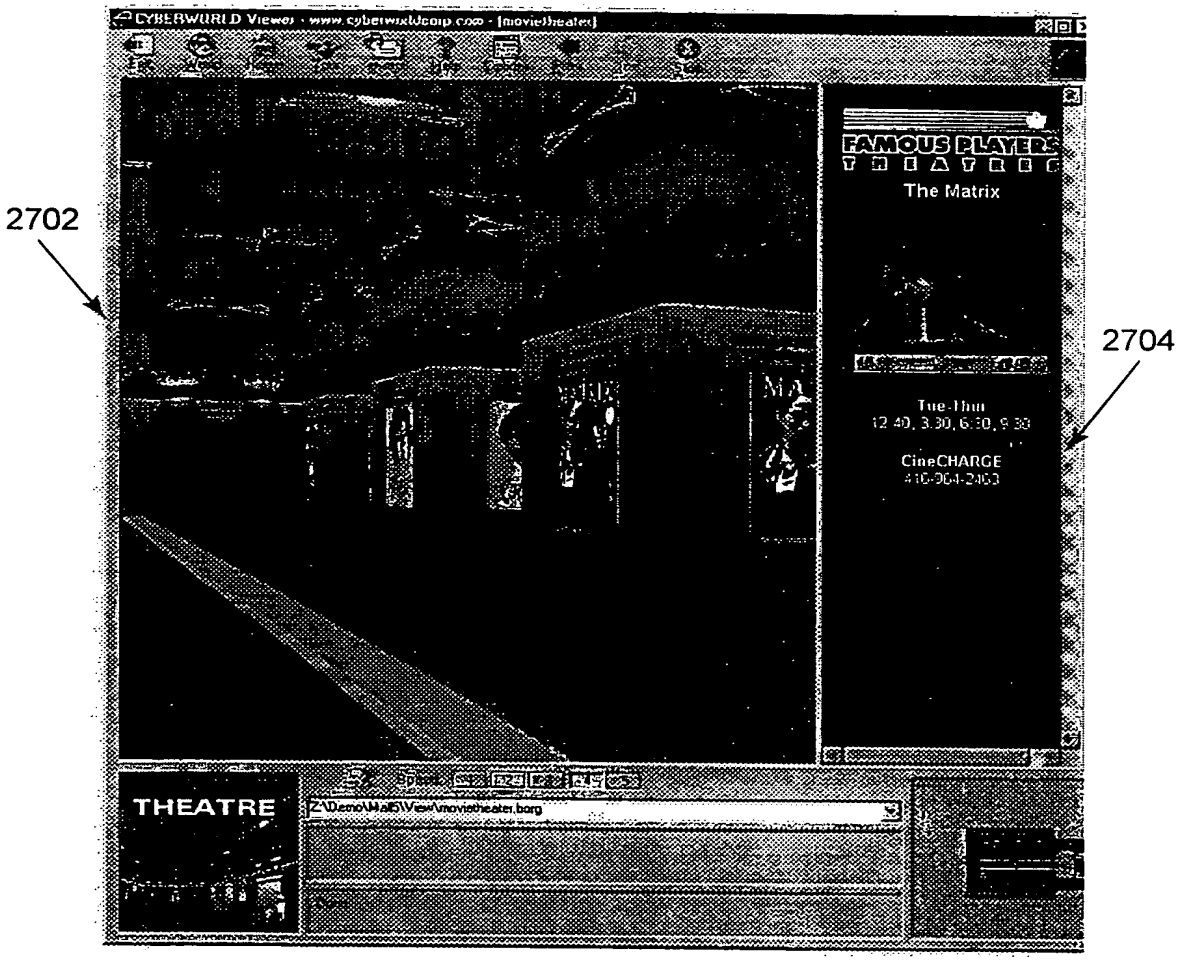


Figure 27

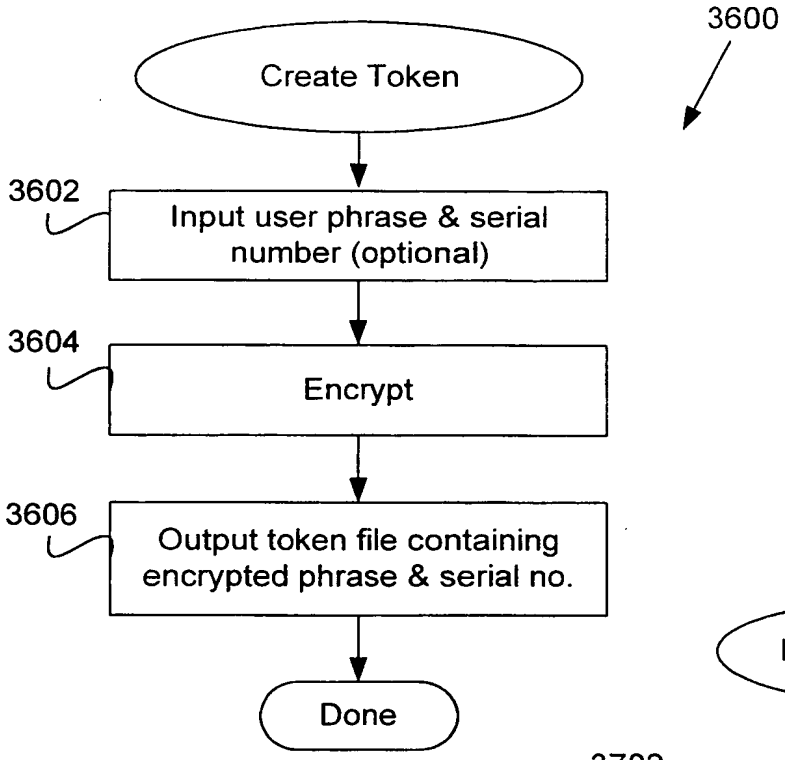


Figure 28

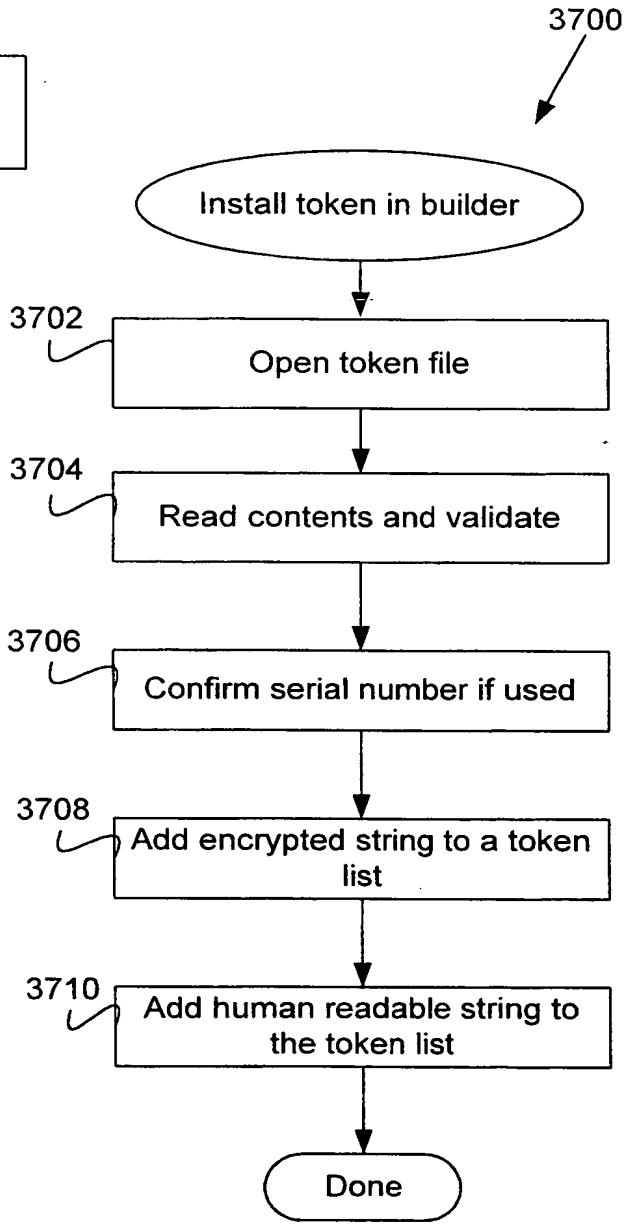


Figure 29

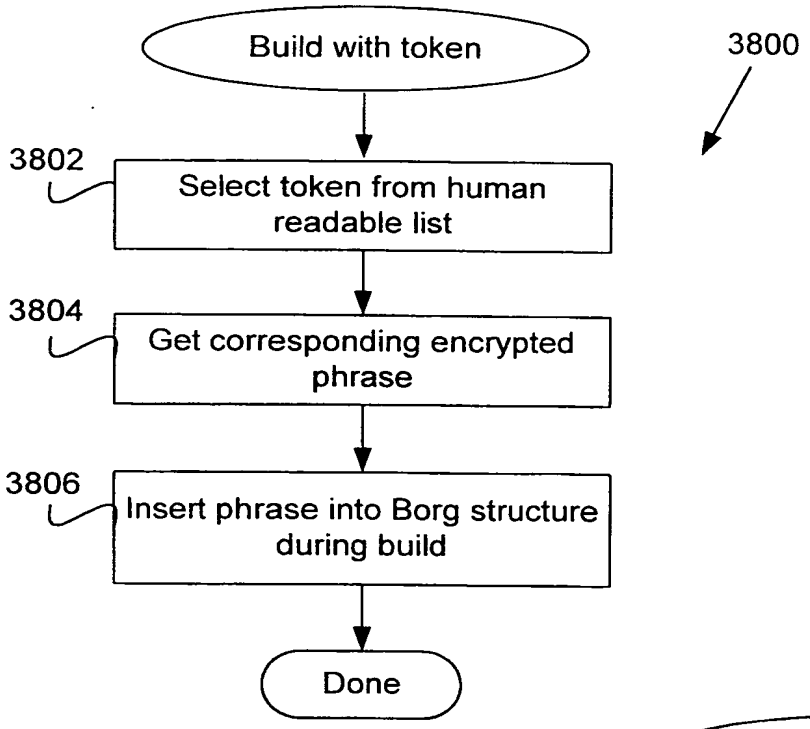


Figure 30

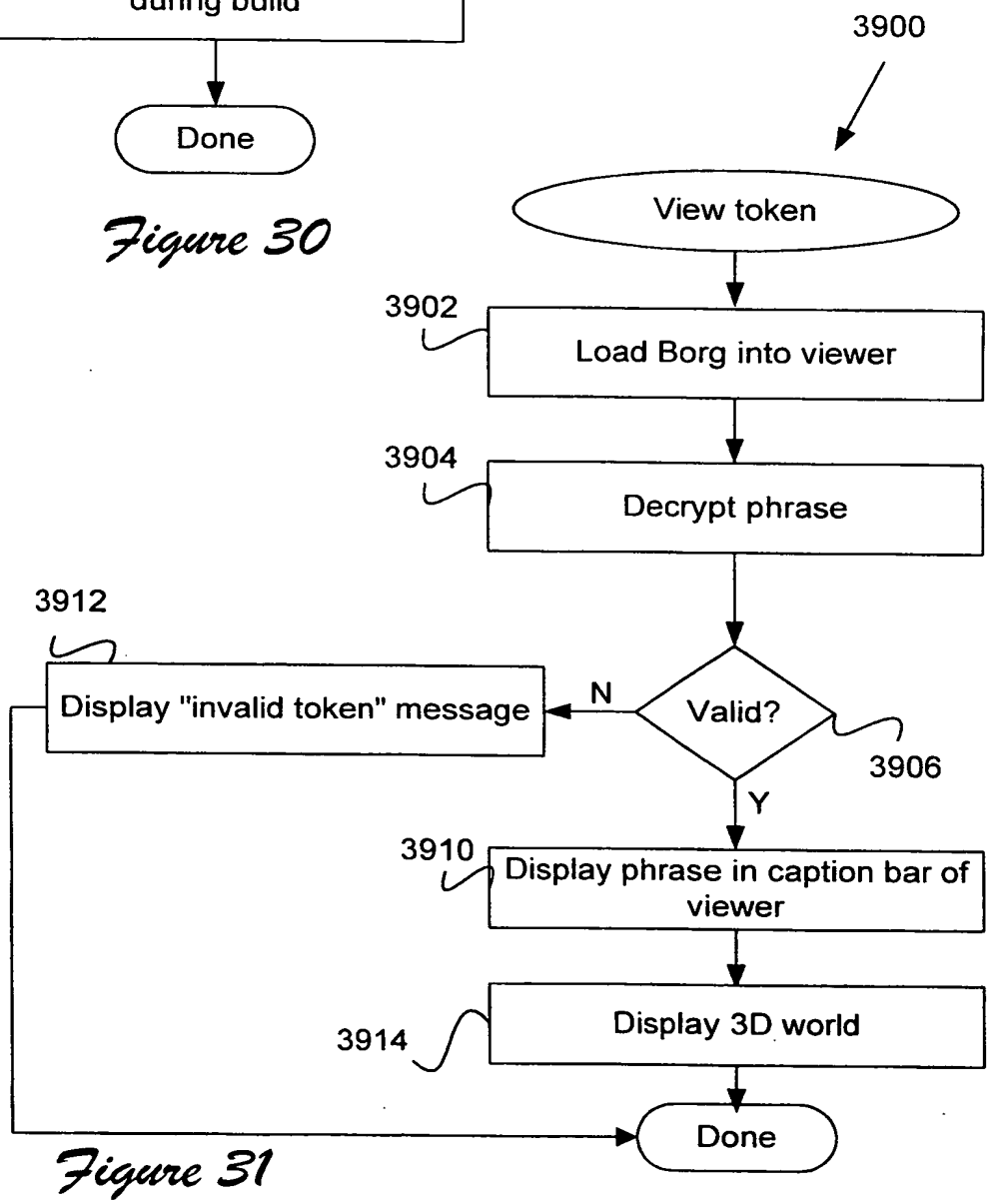


Figure 31